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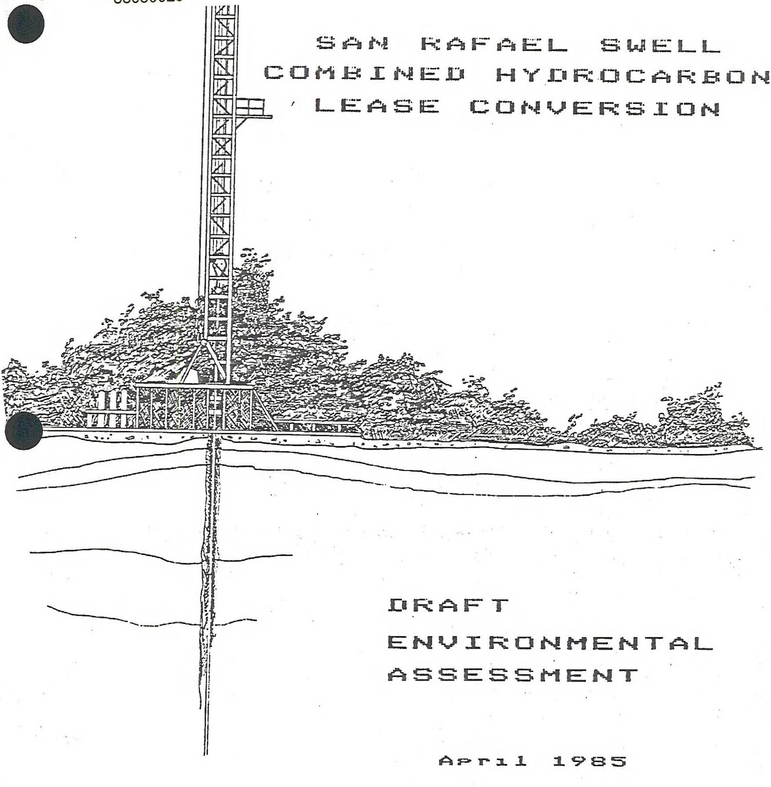

## DRAFT ENVIRONMENTAL ASSESSMENT

April 1985

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U-44400
(U-067)

# Combined Hydrocarbon Lease Conversion
# Draft Environmental Assessment

Kirkwood Oil and Gas
and
Richard J. Valentine
Leases

San Rafael Swell Special Tar Sand Area

San Rafael Resource Area
Price, Utah
1985

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## TABLE OF CONTENTS

Page

I. INTRODUCTION .... 1
A. Authority .... 1
B. Purpose and Need .... 1
II. DESCRIPTION OF PROPOSED ACTIONS AND ALTERNATIVES .... 1
A. William C. Kirkwood Oil and Gas .... 1
1. Applicant's Proposed Action .... 2
a. Exploration .... 2
b. Pilot Plant .... 3
c. Production .... 3
2. Reduced Production Alternative .... 5
3. Altervative Technology Alternative .... 5
4. No Action Alternative .... 5
B. Richard J. Valentine .... 5
1. Applicant's Proposed Action .... 6
a. Exploration .... 6
b. Pilot Plant .... 6
c. Production .... 7
2. No Action Alternative .... 8
C. BLM Required Mitigation Measures .... 8
III. AFFECTED ENVIRONMENT .... 10
A. Natural Environment .... 10
1. Climate .... 10
2. Air Quality .... 10
3. Topography .... 12
4. Geology .... 12
5. Soils .... 14
6. Water .... 14
7. Vegetation .... 15
8. Wildlife .... 15
B. Cultural Environment .... 15
1. Land Use .... 15
a. Grazing .... 15
b. Minerals .... 16
c. Recreation .... 16
2. Cultural Resources .... 16
3. Visual Resources .... 16
4. Land Use Plans .... 17
5. Socioeconomics .... 17
IV. ENVIRONMENTAL CONSEQUENCES .... 22
A. Analysis Assumptions .... 23
B. Kirkwood Leases .... 24
1. Applicant's Proposed Action .... 24
a. Natural Environment .... 24
(1) Air Quality .... 24
(2) Geology .... 27
(3) Soils .... 27
(4) Vegetation .... 28
(5) Wildlife .... 28

Page

b. Cultural Environment .................... 28
(1) Land Use .................... 28
(a) Grazing .................... 28
(b) Minerals .................... 29
(c) Recreation .................... 29
(2) Cultural Resources .................... 29
(3) Visual Resources .................... 29
(4) Land Use Plans .................... 30
(5) Socioeconomics .................... 30
2. Reduced Production Alternative .................... 33
a. Natural Environment .................... 33
(1) Air Quality .................... 33
(2) Geology .................... 34
(3) Soils .................... 35
(4) Vegetation .................... 35
(5) Wildlife .................... 35
b. Cultural Environment .................... 35
(1) Land Use .................... 35
(a) Grazing .................... 35
(b) Minerals .................... 35
(c) Recreation .................... 35
(2) Cultural Resources .................... 35
(3) Visual Resources .................... 35
(4) Land Use Plans .................... 36
(5) Socioeconomics .................... 36
3. Alternative Technology Alternative .................... 36
a. Natural Environment .................... 36
(1) Air Quality .................... 36
(2) Geology .................... 36
(3) Soils .................... 38
(4) Vegetation .................... 38
(5) Wildlife .................... 38
b. Cultural Environment .................... 39
(1) Land Use .................... 39
(a) Grazing .................... 39
(b) Minerals .................... 39
(c) Recreation .................... 39
(2) Cultural Resources .................... 39
(3) Visual Resources .................... 39
(4) Land Use Plans .................... 39
(5) Socioeconomics .................... 39
4. No Action Alternative .................... 40
C. Richard J. Valentine Lease .................... 40
1. Applicant's Proposed Action .................... 40
a. Natural Environment .................... 40
(1) Air Quality .................... 40
(2) Geology .................... 40
(3) Soils .................... 40
(4) Vegetation .................... 41
(5) Wildlife .................... 41

Page

b. Cultural Environment .................... 41
(1) Land Use .................... 41
(a) Grazing .................... 41
(b) Minerals .................... 41
(c) Recreation .................... 42
(2) Cultural Resources .................... 42
(3) Visual Resources .................... 42
(4) Land Use Plans .................... 42
(5) Socioeconomics .................... 43
2. No Action Alternative .................... 43
D. Cumulative Impact Analysis of Both Projects .................... 43
1. Natural Environment .................... 43
a. Air Quality .................... 43
b. Geology .................... 43
c. Soils .................... 43
d. Vegetation .................... 44
e. Wildlife .................... 44
2. Cultural Environment .................... 44
a. Land Use .................... 44
(1) Grazing .................... 44
(2) Minerals .................... 44
(3) Recreation .................... 44
b. Cultural Resources .................... 44
c. Visual Resources .................... 45
d. Socioeconomics .................... 45
V. CONSULTATION AND COORDINATION .................... 45
A. Agencies and Individuals Consulted .................... 45
B. Public Comment .................... 45
VI. PARTICIPATING STAFF .................... 45

References .................... 47

APPENDIXES

Appendix I - Maps
Appendix II - Wind Rose
Appendix III - Vegetation Communities
Appendix IV - VRM Management Classes
Appendix V - Air Quality
Appendix VI - VRM Contrast Ratings
Appendix VII - Checklist for Environmental Assessment and Environmental Assessment Worksheet

# I. INTRODUCTION

## A. Authority

The Combined Hydrocarbon Leasing Act of 1981 (Public Law 97-78) allows existing oil and gas leases within Special Tar Sand Areas (STSAs) to be converted to Combined Hydrocarbon Leases (CHLs). The Act required that a complete Plan of Operations be submitted by November 16, 1983, which assured reasonable environmental protection and diligent development. Two Plans of Operations were received for converting existing oil and gas leases within the San Rafael STSA. In accordance with appropriate regulations (43 CFR 3140), this environmental assessment (EA) is being prepared to determine whether or not the applicant's proposed actions can be carried out with assurance of reasonable environmental protection.

## B. Purpose and Need

The Utah Combined Hydrocarbon Leasing Regional Final EIS (BLM, 1984) provides an overview and cumulative impact analysis of potential tar sand development in Utah resulting from enactment of the Combined Hydrocarbon Leasing Act and provides an analysis of alternatives for amending leasing categories in the San Rafael Swell STSA as established in the San Rafael Management Framework Plan (MFP) (BLM, 1979). The Record of Decision provided an amendment decision which will guide the tar sand program in the San Rafael STSA. The Regional Final EIS is incorporated into this EA by reference. The purpose of this EA is to analyze site specific impacts of conversion on two tracts within the San Rafael Swell STSA. It is consistent with and does not duplicate analyses in the Regional EIS.

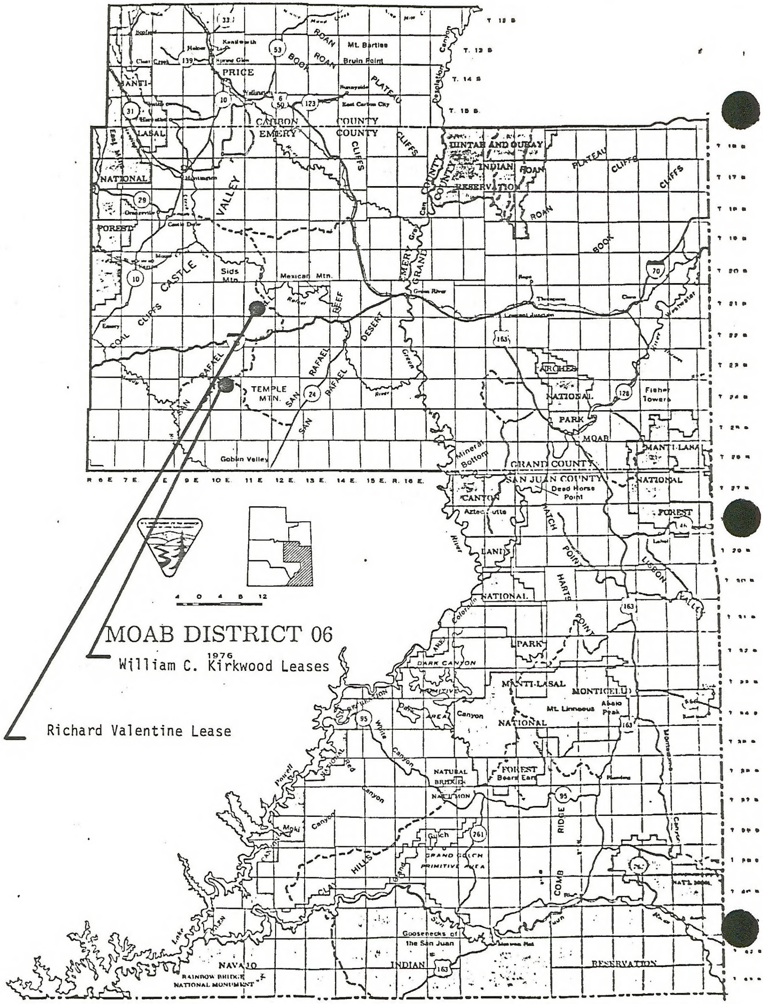
Two separate conversion applications have been received for insitu synfuel production (Figure 1). This EA discusses only the lease conversions described in each of the two proposals. Should either proposal be significantly modified as plans of operation are perfected, additional environmental analysis would be required. Rights-of-way for support functions such as new roads off-tract, powerlines and pipelines would require separate actions and review.

# II. DESCRIPTION OF PROPOSED ACTIONS AND ALTERNATIVES

## A. William C. Kirkwood Oil and Gas

Oil and gas leases U-44399 and U-44400 are held by William C. Kirkwood, who wishes to convert the leases to a CHL and has submitted a plan of operations for development of the tar sand resource.

The Kirkwood leases are in the south central part of the San Rafael Swell STSA in Emery County, Utah (Figures 2 and 3). The leases are located about 25 miles southwest of Green River, Utah. The legal description and ownership are shown in Table 1.



MOAB DISTRICT 06

1976
William C. Kirkwood Leases

Richard Valentine Lease

FIGURE 1

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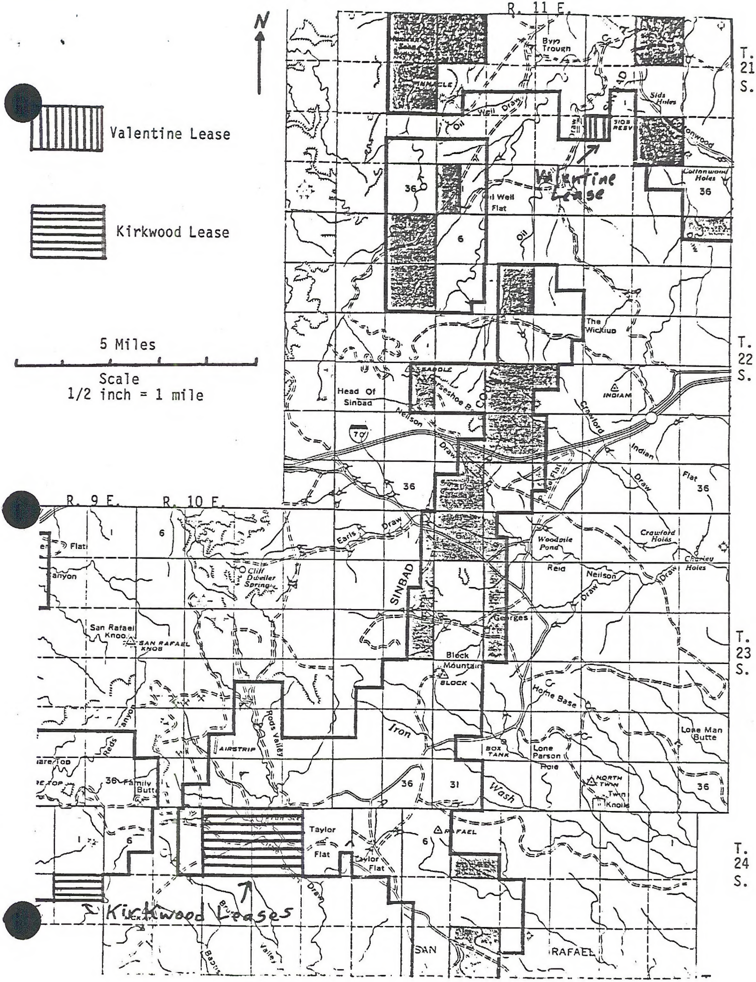
 N
Valentine Lease
Kirkwood Lease
5 Miles
Scale
1/2 inch = 1 mile
R. 11 E.
R. 9 E.
R. 10 E.
T. 21 S.
T. 22 S.
T. 23 S.
T. 24 S.
Byrn Trough
Sids Holes
Oil Well Draw
Valentine Lease
Oil Well Flat
Cottonwood Holes
The Wickiup
Head Of Sinbad
Saddle
Horseshoe B
Indian
Crawford
70
Nelson Draw
Indian Draw
Flat
Earls Draw
Woodside Pond
Crawford Holes
Charley Holes
Reid
Neilson Draw
Cliff Dweller Spring
Sinbad
San Rafael Knoo.
San Rafael Knob
Georges
Block Mountain
Block
Home Base
Iron
Box Tank
Lone Parson Hole
Lone Man Butte
North Twin
Twin Knolls
Wash
Reds Canyon
Reds Valley
Airstrip
Family Butte
Taylor Flat
Taylor Flat
Rafael
Draw
Kirkwood Leases
San
Rafael
36
6
1
31

Figure 2

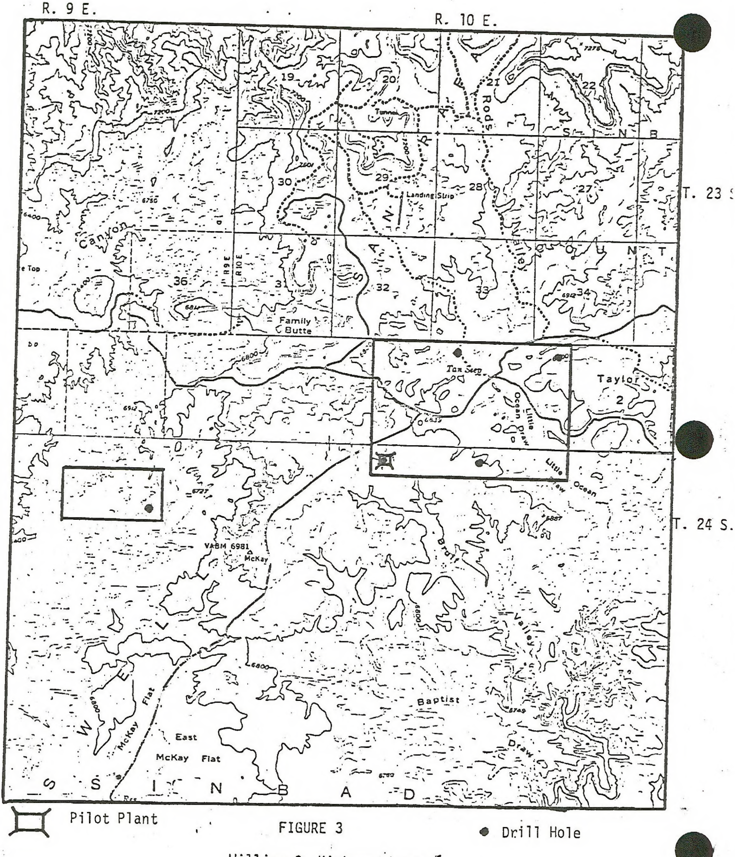


FIGURE 3

William C. Kirkwood Lease

TABLE 1

Kirkwood Leases
Tract Location and Ownership

| | Surface Ownership (Acres) | | Combined Hydrocarbon Ownership (Acres) | | |
|---|---|---|---|---|---|
| Location | Federal | Private | Federal | Private | Legal Description |
| T. 24 S., R. 9 E., SLB&M | | | | | |
| Section 12 | 320.00 | | 320.00 | | N1/2 |
| T. 24 S., R. 10 E., SLB&M | | | | | |
| Section 3 | 879.00 | | 879.00 | | All |
| Section 4 | 879.00 | | 879.00 | | All |
| Total | 2,078.00 | | 2,078.00 | | |

The entire 2,078-acre proposed lease conversion area is believed to be underlain by tar sand. Depth of the overburden is unknown.

The in-place resource is estimated to be 100 million barrels of bitumen, based on data from core holes on and near the tract. Because onsite data are incomplete, the tar sand measurement could be considered an in-place resource rather than a reserve base.

## 1. Applicant's Proposed Action

The tar sand would be extracted by insitu methods. The development would occur in three separate phases: exploration, pilot plant and production.

### a. Exploration

Five drill holes would be drilled, one in Section 12, SE1/4NE1/4; two in Section 4, NE1/4NE1/4, SW1/4SW1/4; and two in Section 3, NE1/4NE1/4, and SW1/4SW1/4 (Figure 3). Access would be from I-70 by way of the county road. An estimated 2.5 miles of new access road would be required. A truck-mounted drill rig would be used to drill and core the oil-saturated zones in the Moenkopi and Coconino Formations. After drilling, each hole would be logged. The drill site would be no larger than 100 by 100 feet.

Drilling would be expected to begin May 1, 1985 and be completed by August 1, 1986, providing the lease is approved early in 1985. Total estimated surface disturbance would be less than 7 acres. A four-man crew would operate the drilling rig. Approximately 200 barrels (0.026 acre-foot) of water would be required to drill and complete each hole. A trailer for housing the personnel would be located onsite.

Any uneconomic holes would be plugged and abandoned, while holes encountering tar sand would be only temporarily abandoned.

The landing strip in T. 23 S., R. 10 E., Section 29 may be used in transportation of personnel and supplies. It is expected that two flights per day would meet the needs of the operation.

b. Pilot Plant

The pilot location would probably be in SW1/4SW1/4, Section 4 and would consist of 5 acres (Figure 3).

The 26 miles of access roads would have to be upgraded. Nine wells would be drilled on the 5-acre site. The center well would be the injection well, while the four wells at the corners of the site would be the production wells. Four monitor wells would be located between the injection well and the production wells (Figure 4).

Air would be injected and a combustion front started in the tar sand. Water and/or steam may also be injected. The bitumen would be liquified and pumped out at the production well (Figure 5). An estimated 240,000 barrels of bitumen underlie the pilot site and, at 20 to 40 percent recovery, 48,000 to 96,000 barrels would be recovered. The pilot project would begin July 1, 1987 and be completed by July 1, 1991. An estimated 25 men would be required to operate the pilot plant plus a four-man crew to drill the wells.

Facilities would include: air compressors, electric generators, storage tanks, pumping units, fuel and water storage, housing and warehouse.

Water requirements would be 0.8 acre-foot or 6,207 barrels per year and would be obtained from a well or would have to be trucked in. Total surface disturbance on lease would be 10 acres.

The produced bitumen would be hauled out by trucks with a capacity of 200 barrels. At a maximum production of 2,000 barrels per day, 10 truck trips per day would be required. The bitumen would probably be delivered to the railhead in Green River, where it would be put in tanker cars and shipped to a refinery.

c. Production

The 2,078-acre tract would be divided into 20-acre production sites. Thirteen wells would be drilled on a site. Eight production wells would be drilled at the boundary of the site and one in the center. Four injection wells would be drilled between the center and the site boundary (Figure 6). Each site would be in production from 3 to 5 years. Construction on the production phase would begin on January 1, 1991, and the first actual production would occur 1 year later. The operation is expected to last 25 to 30 years. The extraction process would be similar to that described in the pilot phase.

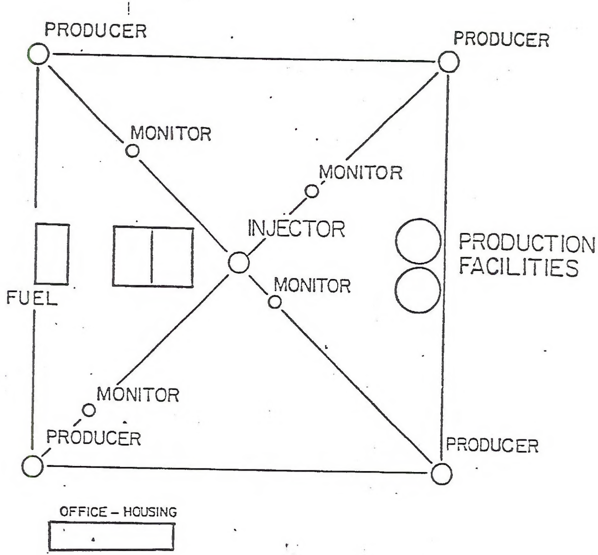
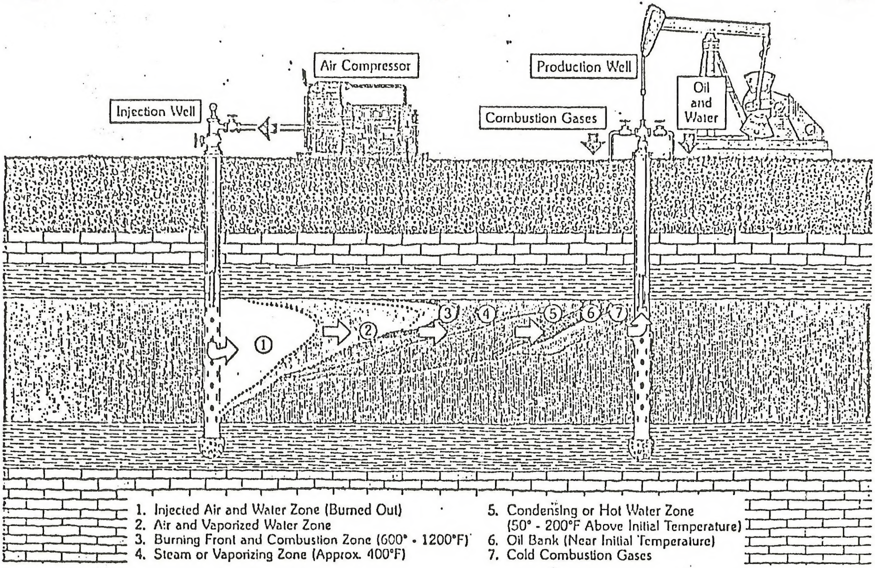


FIGURE 4. PILOT PATTERN IN-SITU COMBUSTION (KIRKWOOD)

# In-Situ C[illegible]bustion



1. Injected Air and Water Zone (Burned Out)
2. Air and Vaporized Water Zone
3. Burning Front and Combustion Zone (600° - 1200°F)
4. Steam or Vaporizing Zone (Approx. 400°F)
5. Condensing or Hot Water Zone (50° - 200°F Above Initial Temperature)
6. Oil Bank (Near Initial Temperature)
7. Cold Combustion Gases

Heat is used to thin the oil and permit it to flow more easily toward production wells. The formation is ignited by a fireflood, creating a combustion front which is driven by air injection. The mobility of the oil, in particular, heavy crude, is increased by reduced viscosity caused by the heat and solution of combustion gases.

FIGURE 5. SCHEMATIC DIAGRAM OF IN-SITU RECOVERY (KIRKWOOD)

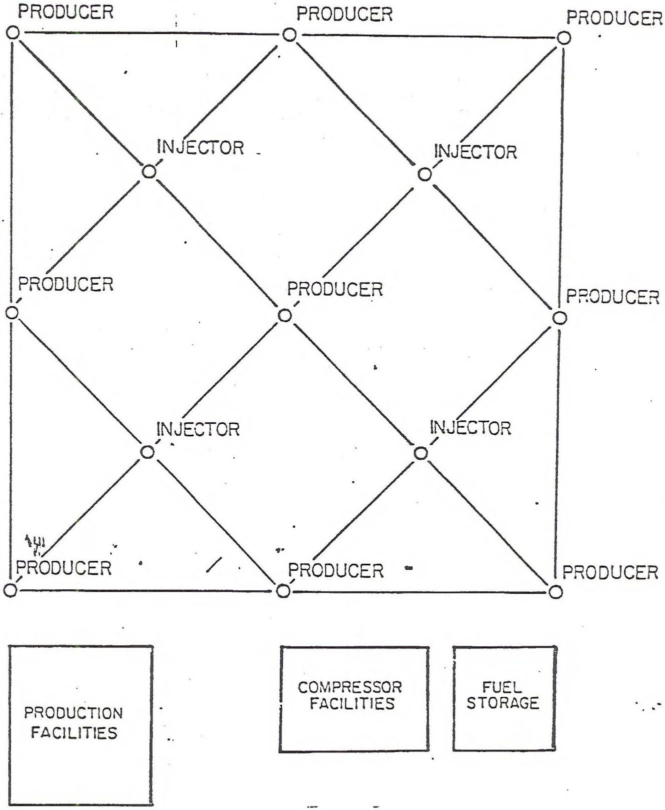
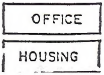


FIGURE 6. DEVELOPMENT PATTERN IN-SITU COMBUSTION (KIRKWOOD)



Facilities required include: air compressors, electric generators, production tanks, gathering lines, dehydration equipment, fuel storage, housing, warehouse, repair shop, and sewage facilities.

An estimated 1,560 acres would be disturbed to some degree over the 25 to 30-year life of the project, but no more than 375 acres are expected to be disturbed at any one time. Reclamation would begin in the seventh year (1997) and would be completed within 7 years after production ceased and would be completed no later than 2027. Disturbed areas would be restored to approximately the original contour, the topsoil restored, and the area seeded with native plant species.

This alternative would require .05 barrel of water for every barrel of bitumen produced. The operation would require 6.5 acre-feet of water per year, which would have to be trucked or piped in. A possible source is the Green River. Water rights would have to be obtained.

The bitumen produced would probably be trucked to the Green River railhead where it would be loaded onto tanker cars and shipped to a refinery. At a maximum production of 16,000 barrels per day and using 200 barrel trucks, 80 trips per day would be required. A pipeline could also be used instead of trucks.

At peak personnel requirements in the 10th year (2000), 238 workers would be required of which 150 would be in construction, 80 in operations, and 8 in reclamation. Labor requirements by year are shown in Table 2. Workers would probably reside and commute from the nearest communities, which are Green River and Hanksville.

TABLE 2

Manpower Requirements

| Phase | Year | Manpower Requirements |
|---|---|---|
| Exploration | 1985 | 4 |
| | 1986 | 4 |
| Pilot Plant | 1987 | 29 |
| | 1988 | 29 |
| | 1989 | 29 |
| | 1990 | 29 |
| Production | 1991 | 108 |
| | 1992 | 140 |
| | 1993 | 140 |
| | 1994 | 140 |
| | 1995 | 180 |
| | 1996 | 180 |
| | 1997 | 186 |
| | 1998 | 236 |
| | 1999 | 236 |
| | 2000 | 238 |

### 2. Reduced Production Alternative

This alternative is similar to the proposed development section, but the production rate would be reduced to 2,000 barrels per day, increasing the operation's life to 137 years. The work force would be 30. Water requirements would be 0.8 acre-foot per year. No more than 10 truck trips per day would be needed to haul bitumen. No more than 50 acres would be disturbed at any one time. Reclamation would be completed within 7 years after cessation of the operation. This alternative was included in order to compare impacts to air quality with impacts to air quality from the applicant's proposed action.

### 3. Alternate Technology Alternative

This alternative would be the same as the proposed development except a water flood or steam flood method would be used, which would require 5 barrels of water for every barrel of bitumen produced. Water requirements over the 30-year life of the operation would be 13,000 to 26,000 acre-feet, which would average 433 to 867 acre-feet per year. It is assumed that the work force would be 60 percent greater than the proposed action, so that 381 workers would be required at peak employment.

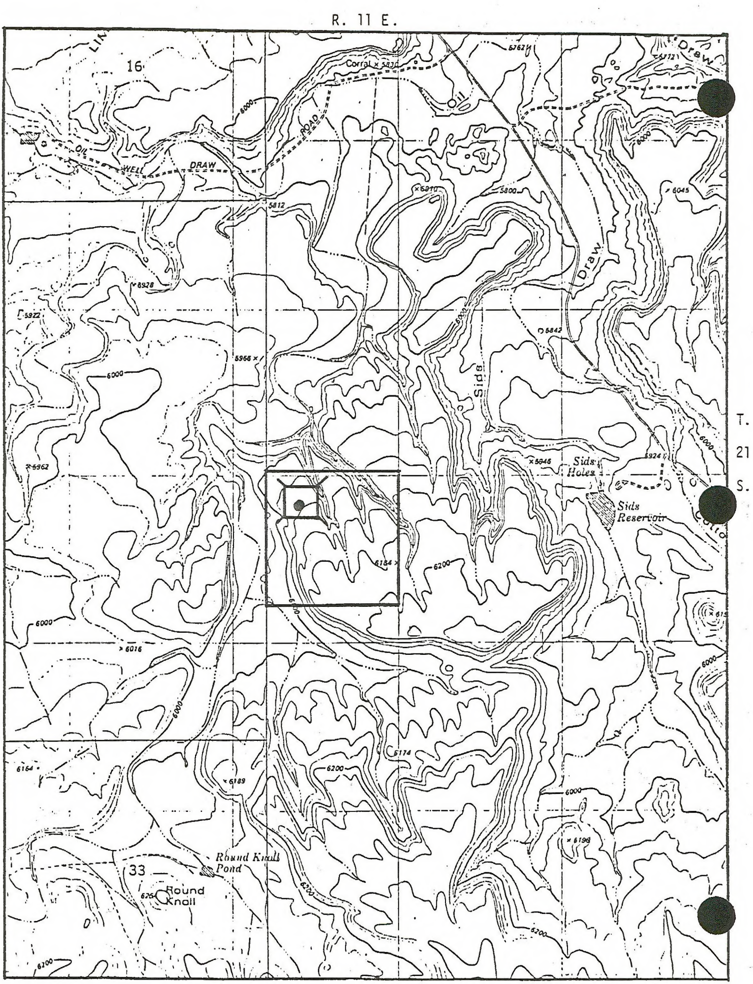
### 4. No Action Alternative

If the No Action alternative is selected, the combined hydrocarbon lease would not be issued. No holes would be drilled, no roads upgraded, no water consumed for this project, and no bitumen produced.

## B. Richard J. Valentine

Oil and gas lease U-37239 is held by Richard J. Valentine, who wishes to convert the lease to a CHL and has submitted a plan of operations for development of the tar sand resource.

The Valentine lease is in the west central part of the San Rafael Swell STSA in Emery County, Utah. The lease is located about 16 miles west of Green River, Utah (Figures 2 and 7). The legal description and ownership are shown in Table 3.



⌶ Pilot Plant

Richard Valentine Lease

FIGURE 7

● Drill Hole

## TABLE 3

Valentine Lease
Tract Location and Ownership

| | Surface Ownership (Acres) | | Combined Hydrocarbon Ownership (Acres) | | |
|---|---|---|---|---|---|
| Location | Federal | Private | Federal | Private | Legal Description |
| T. 21 S., R. 11 E., SLB&M | | | | | |
| Section 27 | 160.00 | | 160.00 | | NW1/4 |
| Total | 160.00 | | 160.00 | | |

The lease contains 160 acres and is believed to be entirely underlain by tar sand. The overburden ranges from 160 feet in the northern part of the lease to 320 feet in the western part.

The in-place resource is estimated at 340,000 barrels of bitumen, based on data points outside the tract boundaries. Due to a lack of onsite data, the tar sand measurement should be considered an in-place resource rather than a reserve base.

### 1. Applicant's Proposed Action

The tar sand would be extracted by insitu methods. The development would occur in three separate phases: exploration, pilot plant, and production.

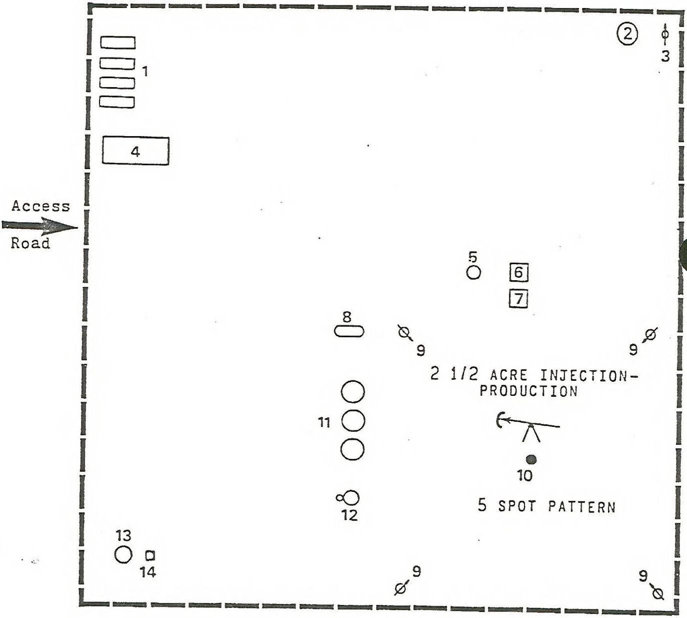
### a. Exploration

A drill hole would be drilled in the center of the NW1/4NW1/4 of Section 27 (Figure 7). Access would be from I-70 to the Cottonwood road, then to the Oil Well Draw road. The last 0.5 mile of road to the site would have to be constructed. A portable truck-mounted drill rig would be used to core the oil-saturated zone. The drill site would take up an area no bigger than 100 by 100 feet. Drilling would last no more than 2 weeks. Assuming the lease is approved in early 1985, the drilling could be done in the summer of 1985. Total estimated surface disturbance would be about 2 acres.

### b. Pilot Plant

The pilot location would be in the center of the NW1/4NW1/4 of Section 27 and would consist of 10 acres (Figure 7). The access road would be upgraded. Five wells would be drilled on 2.5 acres. The four outer wells would be at the corners of the site and would be the injection wells. The center well would be the production well (Figure 8). Air and water or steam would be injected and a combustion front started in the tar sand. The bitumen would be

FIGURE 8. PILOT PATTERN IN-SITU COMBUSTION
(VALENTINE)



KEY TO NUMBERS

| | |
|---|---|
| 1 | PERSONNEL HOUSING |
| 2 | FRESH WATER TANK |
| 3 | FRESH WATER WELL |
| 4 | SUPPLIES AND MAINTENANCE WAREHHOUSE |
| 5 | DIESEL FUEL STORAGE |
| 6 | ELECTRIC GENERATOR |
| 7 | AIR COMPRESSOR |
| 8 | PROPANE STORAGE TANK |
| 9 | AIR INJECTION WELLS |
| 10 | PRODUCTION WELL |
| 11 | PRODUCED OIL STORAGE TANKS |
| 12 | DEHYDRATOR |
| 13 | PRODUCED WATER TANK |
| 14 | WATER PUMP |

liquified and pumped out at the production well. An estimated 5,000 barrels of bitumen underlie the pilot site and, at 20 to 40 percent recovery, 1,000 to 2,000 barrels would be recovered. The bitumen would be hauled by truck to the railhead by Green River. The pilot project would last 1.1 years and would be operated by four workers. Facilities would include: air compressors, power generator, storage tanks, pumping units, dehydration equipment, water supply equipment, fuel storage, housing, and a warehouse.

Water requirements would be 1 to 3 acre-feet and would be obtained from a well or trucked in. Total surface disturbance is estimated to be no more than 10 acres.

### c. Production

The 160-acre tract would be divided into 17 production sites ranging from 5 to 20 acres each. The first 20-acre site would include the pilot site. Thirteen additional wells would be drilled, so that there would be nine injection wells and nine production wells. Each site would be in production for about 1 year, so the life of the project would be 17 years beginning in 1988. The extraction process would be similar to that described in the pilot phase.

At the assumed 20 to 40 percent recovery rate, 67,000 to 134,000 barrels of bitumen would be recovered during the production phase of the project. Facilities required would include: air compressors, electric generators, production tanks, dehydration equipment, recovery system, fuel storage, housing, warehouse, repair shop, and sewage facilities. An estimated 120 acres of the lease would be disturbed to some degree during the life of the project. Upgrading the access roads off lease would probably disturb another 30 acres.

The operation would require 49 to 94 acre-feet of water from a well or possibly trucked or piped in from the Green River. This would average 3.0 to 5.5 acre-feet per year. This is based upon use of 5 barrels of water for every barrel of bitumen produced.

The bitumen produced would probably be trucked to Green River railhead where it would be loaded into tanker cars and shipped to a refinery. Less than one truck trip per week would be required for a truck with a capacity of 200 barrels.

It is estimated that four workers would be required to run the production site. Various other personnel would be required for short periods of time.

Reclamation would begin 5 years after the beginning of production and would be completed 5 years after production ceased. Reclamation should be completed by 2010. Disturbed areas would be restored to approximately the original contour, the topsoil restored and the area seeded with native plant species.

### 2. No Action Alternative

If the No Action alternative is selected, the combined hydrocarbon lease would not be issued. No holes would be drilled, no roads upgraded, no water consumed for this project, and no bitumen produced.

## C. BLM Required Mitigation Measures

The following mitigation measures would apply to all proposed actions and alternatives except the no action alternative.

1. Prior to entry upon the land or the disturbance thereof for mining, drilling, or other purposes, the lessee shall submit for approval a plan of operations to the authorized officer of BLM and the appropriate surface management agency. The plan shall meet the requirements of 43 CFR 3160 for drilling and insitu operations and 43 CFR 3570 for mining operations. The submitted plan of operations must be in compliance with applicable operation orders and notices to lessees and must contain, in addition to all requirements stated above, the methods and actions proposed for the following:

a. Stripping and saving of topsoil.

b. Reclamation of the disturbed areas, including, but not limited to recontouring and revegetation with native species or ecological equivalents.

c. Erosion control measures on all disturbed areas, roads, and waterway crossings.

d. Road design, construction, and maintenance standards would be subject to BLM 9113 Roads Manual.

e. Cultural resource protection and clearance and/or protection plan would be required prior to all surface-disturbing activities. All costs of inventory and data recovery would be borne by the lessee.

f. Livestock protection such as fencing or otherwise excluding livestock from active mining areas.

g. Fugitive dust and emissions control with fugitive dust abatement being required on all major haulage roads.

h. Wildlife protection and mitigation would include threatened or endangered species. Clearance would have to be given by the appropriate agency prior to any surface disturbance, and all transmission lines would be raptor-proof.

i. Protection of streams, springs, water wells, and other water sources would include, but would not be limited to, stream and drainage crossings being protected by appropriate stipulations, including a U.S. Army Corps of Engineers 404 Permit.

j. Methods of retaining all mine drainage and runoff onsite.

k. Environmental analysis will be made by the authorized officer in consultation with the appropriate surface management agency for the purpose of assuring proper protection of the surface, the natural resources, the environment, existing improvements, and for assuring timely reclamation of disturbed lands.

2. Upon completion of said environmental analysis, the BLM, as appropriate, shall notify lessee of the conditions, if any, to which the proposed surface disturbing operations will be subject.

Said conditions may relate to any of the following:

a. Location of drilling or other exploratory or developmental operations or the manner in which they are to be conducted, and

b. Manner or location in which improvements such as roads, buildings, pipelines, or other improvements are to be constructed.

3. The Federal surface management agency is responsible for assuring that the area to be disturbed is examined, prior to undertaking any surface-disturbing activities on lands covered by this lease, to determine effects upon any plant or animal species listed or proposed for listing as endangered or threatened, or their habitats. If the findings of this examination determine that the operation may detrimentally affect an endangered or threatened species, some restrictions to the operator's plans or even disallowances of use may result.

The lessee/operator may, at his discretion and cost, conduct the examination on the lands to be disturbed. This examination must be done by or under the supervision of a qualified resource specialist approved by the surface management agency. An acceptable report must be provided to the surface management agency identifying the anticipated effects of the proposed action on endangered or threatened species or their habitat.

4. The Federal surface management agency is responsible for determining the presence of cultural resources and specifying mitigation measures required to protect them. Prior to undertaking any surface-disturbing activity on the lands covered by this lease, the lessee/operator, unless notified to the contrary by the authorized officer of the surface management agency, shall:

a. Engage the services of a qualified cultural resource specialist acceptable to the surface management agency to conduct an intensive inventory for evidence of cultural resource values;

b. Submit a report acceptable to the authorized officer of the surface management agency; and

c. Implement such mitigation measures as required by the authorized officer of the surface management agency to preserve or avoid destruction of inventoried cultural resource values. Mitigation may include relocation of proposed facilities, testing, and salvage or other protective measures deemed necessary. All costs of the inventory and mitigation shall be borne by the lessee/operator and all data and materials salvaged shall remain under the jurisdiction of the U.S. Government.

The lessee/operator shall immediately bring to the attention of the authorized officer of the surface management agency any cultural resources, paleontological, and other objects of scientific interest discovered as a result of surface operations under this lease and shall leave such discoveries intact until directed to proceed by the BLM.

5. To protect important aquifers, all surface and insitu mining must be preceded by complete hydrological testing and evaluation as specified by the authorized officer of BLM. Any loss of springs or reduction in perennial stream flow will be fully mitigated with an equal quantity and quality of water lost. Such mitigation must be approved by the authorized officer of BLM.

## III. AFFECTED ENVIRONMENT

Only those parts of the environment that would be significantly impacted by the proposed action or alternatives are described here.

### A. Natural Environment

### 1. Climate

The tract lies in an arid climate area receiving 8 to 10 inches average annual precipitation (Hodder, et al., 1979). Winters are fairly dry, accounting for about 39 percent of the year's total moisture. Most precipitation is received from May to August resulting from intense, localized, short-duration thunderstorms (BLM, 1981). Such storms supply little usable water to plant growth; two-thirds of such moisture is lost to evapotranspiration (Hodder, et al., 1979).

Relative humidity is considered low. Average annual temperature is about 46 degrees F (Jewell, 1979). The number of freeze-free days ranges from 80 to 120. Droughts occur on an average of once every 5 years. Evapotranspiration potential ranges from 21 to 24 inches (Jewell, 1979). Seasonal and daily temperature extremes produce active forces (associated with freezing and thawing) that accelerate natural weathering and breakdown of rocks, soils, and roads.

### 2. Air Quality

Limited local wind data (Jewell, 1979) suggest that winds are generally from the north through northwest at 3 to 5 miles per hour (mi/h) in the fall, winter, and early spring. In late spring and summer, there is a shift to south-southwesterly winds at 8 to 12 mi/h. The strongest winds seem to occur in the fall, attaining maximum velocity at about 30 mi/h. Although the predominant winter air flow is from the north, particularly at night, there is a less persistent reversal flow from the south during the day. The wind rose for Cedar Mountain (see Appendix II) characterizes upper level flows in the San Rafael Swell (Aerocomp, 1984). The wind rose illustrates that westerly winds predominate and southerly flows are of secondary importance.

Upper wind data from Salt Wash (Aerocomp, 1984) does not differ significantly, showing the strongest components from the northwest through southwest sectors.

Atmospheric stability measurements made at Salt Wash indicate that stable conditions prevail throughout the region with unstable conditions occurring less than 15 percent of the time. Neutral stability is expected approximately 30 percent of the time.

These leases lie in the Upper Colorado River air basin, being bounded by the Wasatch Plateau on the west and by the Uinta and Rocky Mountains on the north and east, respectively. These features generally limit flow out of the basin (Aerocomp, 1984). Flow exchanges are more common through the southern boundary. Dispersion conditions important in eliminating pollutants are poorest in the winter when mixing heights are low and wind speeds are light (Aerocomp, 1984).

Air quality in the general area is considered to be very good. Measurements of the annual and 24-hour ambient concentrations of the various pollutants have been made in Green River and in Salt Wash. Measurements made at Salt Wash were only made in 1975. These ambient concentrations are listed below in ug/m$^3$:

| | Salt Wash | Green River |
|---|---|---|
| Annual TSP | 19 | 50 to 60 |
| 24-hour TSP | 90 | 160 to 200 |
| Annual $SO_2$ | less than 13 | less than 13 |
| 24-hour $SO_2$ | less than 13 | 13 to 26 |
| Annual $NO_2$ | 13 | 14 to 20 |
| 1-hour Ozone | 132 | -- |

Background visual ranges at Capitol Reef NP were measured by the National Park Service, EPA, and John Muir Institute from 1978 to 1981 using multiwavelength telephotometers. A Level I visibility analysis (Appendix V) indicates that existing visibility is good. Seasonal average visual range is approximately 160 km to 211 km. The geometric mean of visual range at Capitol Reef is 181 km. The good visibility conditions reflect the presently low regional sulfur dioxide and low relative humidities.

Several sources of both natural and man-caused air quality impacts already occur in this general area (Jewell, 1979). Even so, air quality is very good, with an annual ambient total suspended particulate (TSP) concentration of 19 micrograms per cubic meter (ug/m$^3$). This can be compared to the Utah and National Ambient Air Quality Standards (NAAQS) in Table 4. The maximum ambient 24-hour TSP concentration is 90 ug/m$^3$. Maximum 24-hour and annual ambient sulfur dioxide concentrations are both less than 13 ug/m$^3$. The average annual nitrogen dioxide concentration is 13 ug/m$^3$ and the 1-hour maximum ozone concentration is 132 ug/m$^3$. Background median visual range is 207 kilometers (km) (129 miles) (Aerocomp, 1984).

In addition to NAAQS, Prevention of Significant Deterioration (PSD) limitations protect air quality and related values from undue degradation. The tract is in a PSD Class II area which allows very little air quality deterioration above background levels. Arches, Canyonlands, and Capitol Reef National Parks (NPs) have Class I status and, therefore, must be carefully considered for potential impacts from any major polluting source.

Capitol Reef NP is located about 25 miles southwest of the Kirkwood leases and 44 miles southwest of the Valentine lease. Canyonlands NP lies about 45 and 51 miles, respectively, southeast and Arches NP is about 60 and 54 miles, respectively, due east. The PSD increment limitations pertinent to these areas are shown in Table 5.

TABLE 5

Prevention of Significant Deterioration Incremental Limitations

| Pollutant | Averaging Time | Maximum Allowable Concentration (ug/m$^3$) Class I | Class II |
|---|---|---|---|
| Sulfur dioxide | Annual | 2 | 20 |
| | 24-hour | 5 | 91 |
| | 3-hour | 25 | 512 |
| Total suspended particulate matter | Annual | 5 | 19 |
| | 24-hour | 10 | 37 |

Source: Aerocomp, 1984

### 3. Topography

The leases are located in the central and south central portion of the San Rafael Swell, a breached, doubly plunging anticline. Elevation ranges from 5,940 feet in the western portion to 6,960 feet in the central portion. The leases drain southward into the Muddy River.

### 4. Geology

The Triassic Moenkopi Formation (250 to 850 feet thick) and the Permian Kaibab Limestone (0 to 100 feet thick) outcrop on the leases. The Moenkopi Formation consists of four members, which are (in ascending order) the Black Dragon, Sinbad Limestone, Torrey and Moody Canyon members. The Moenkopi Formation consists of red and buff sandstone, greenish-gray and red siltstone, and

## TABLE 4

## National Ambient Air Quality Standards for National, Colorado, and Utah Levels

| Secondary<br>Pollutant | Averaging Time | (ug/m$^3$)[a] | Primary<br>(ug/m$^3$)[b] |
|---|---|---|---|
| Ozone | 1 hour[c] | | 235 |
| d | | | |
| Carbon monoxide | 8 hour | | 10,000[e] |
| d | | | |
| | 1 hour | | 40,000[e] |
| d | | | |
| Nitrogen dioxide | Annual Arithmetic Mean | 100 | d |
| Sulfur dioxide | Annual Arithmetic Mean | 80 | f |
| | 24-hour | | 365 |
| f | | | |
| | 3-hour | | f |
| 1,300 | | | |
| Total suspended | Annual Geometric Mean | 75 | |
| 60 | | | |
| particulates | 24-hour | | 260 |
| 150 | | | |
| Lead | Calendar Quarter | 1.5 | |
| d | | | |

Source: Aerocomp, 1984

Note: National standards, other than for ozone or those based on annual average: these standards are not to be exceeded more than once per year.

[a] Air quality levels which affect human health (in micrograms per cubic meter).

[b] Air quality levels which affect human welfare (e.g., crops, cropland, other vegetation, and animal life).

[c] The number of days during a calendar year in which one or more hourly values could equal or exceed the ozone standard must be less than or equal to 1.

[d] Same as primary standard.

[e] Micrograms per cubic meter.

[f] Standard not established.

mudstone with a white to gray limestone bed toward the base of the formation. The Torrey and Black Dragon members are the tar-bearing units (Blakey, 1972). The Kaibab Limestone consists of light gray to brown, sandy, cherty limestone. A coquina bed occurs in some areas. The strata dips to the east at 2 to 5 degrees. The tar sand is believed to occur in the Permian Coconino Sandstone (600 to 720 feet thick). This formation underlies the Kaibab Limestone and consists of white and buff, fine-grained, cross-bedded, massive, eolian sandstone with a limestone bed occurring at the base.

The Mokenkopi Formation contains fossils of amphibians, dinosaurs, fish, sharks, clams, oysters, snails, ammonoids, scaphopods, brachiopods, crinoids, crustaceans, worms, sponges, starfish, and sea urchins, while the Kaibab Limestone contains fish, sharks, bryozoans, brachiopods, corals, ammonoids, nautiloids, snails, clams, oysters, scaphopods, ostracods, crinoids, trilobites, echinoids, worms, and scyphozoans. Not all of these fossils are found in any one location, however, and the presence of any of these fossils on the lease is unknown. According to a literature search conducted by Robison (1977), both formations have moderate significance as fossil-bearing units.

### 5. Soils

The leases are composed of about 60 to 70 percent shallow, loamy soils (of which 10 to 50 percent is rock fragments) and 30 to 40 percent rock outcrop. The lease in Sections 3 and 4 on the Kirkwood lease has as much as 20 percent deep, loamy soils.

The shallow soils occur on sloping to steep ridges and hillsides. These soils formed in residuum from sandstone, shale, and limestone and are sandy loams, fine sandy loams, very gravelly sandy loams, and very stony sandy loams. Rock outcrop occurs intermixed with the shallow soils on ridge lines and on ledges.

The deep loamy soils occur along intermittent stream channels and in concave slope positions at the bases of hills. Slopes are 0 to 10 percent. These soils formed in alluvium and are mostly fine sandy loams with some gravelly layers. There are small areas of deep, very stony soils at the bases of steep hillsides.

All of the soils on the leases are moderately alkaline. They have low organic matter content even in the surface layer. Some of the soils have layers of calcium carbonate accumulations at depth or immediately above bedrock, but generally this is weakly expressed.

### 6. Water Resources

Developed ground water exists at Tan Seep (Figure 3). This is covered by a Public Water Reserve Withdrawal (U-52738) covering approximately 100 acres in Section 3, T. 24 S., R. 10 E., SLB&M. The Executive Order of April 17, 1926, withdrew this parcel from settlement, location, sale, or entry. No activity that would interfere with public uses of this water is allowed. The spring is a very important source of water for wildlife and livestock in the area, as it is the only reliable source for several miles. The next nearest source, Family Butte Reservoir, is 2 miles away and does not always contain water.

### 7. Vegetation

Five different vegetation types (see Appendix III for species composition) occur on the leases: grass (80 acres); pinyon-juniper (680 acres); sagebrush (50 acres); desert shrub (1,268 acres); and pinyon-juniper shrub (160 acres).

*Cryptantha jonesiana*, a candidate for the threatened or endangered (T & E) species list (BLM, 1981) has been found on the leases. Because no inventory has been completed on the leases, it is not known if any T & E species occur.

### 8. Wildlife

The leases are located within low quality habitat for mule deer. A limited number (0.71 deer per square mile) of deer occupy the area yearlong (UDWR, 1984).

There are no known raptor nests on these leases; however, the area meets the nesting requirements of many species of raptors, although the prey base is very poor.

Other bird species of high federal interest that could occur on the leases are the golden eagle, prairie falcon, Cooper's hawk, merlin, and the ferruginous hawk. The rough-legged hawk, Swainson's hawk, American kestrel, goshawk, sharp-shinned hawk, marsh hawk, and turkey vulture are present in the region and could occur on the leases. Small and medium-sized wildlife found on or near the lease would include coyotes, foxes, black-tailed jackrabbits, cottontail rabbits, kangaroo rats, and other small rodents and reptiles.

For a complete list of species on or near these leases, refer to Dalton et al., 1978 and Schwinn and Minden, 1979 published by UDWR.

The peregrine falcon could possibly nest on these leases, but the cliffs within the leases are not optimum for nests, and the prey base is low or nonexistent.

No threatened and endangered species are known to occur on the leases (Appendix VII).

## B. Cultural Environment

### 1. Land Use

#### a. Grazing

Three operators graze livestock on three different allotments within these leases during the late fall, winter, and early spring months. One operator grazes sheep in the Taylor Flat Allotment, one cattle in the Red Canyon Allotment, and one cattle and horses in the Oil Well Flat Allotment. Less than 1 percent of the Taylor Flat and Oil Well Flat Allotments are within the leases, and about 1 percent of the Red Canyon Allotment. The leases contain 59 to 84 animal unit months (AUM's). Carrying capacity ranges from 16 to 40 acres per AUM.

### b. Minerals

A survey of the BLM microfiche (dated November 13, 1984) indicated that eight lode claims have been located on the Valentine lease. The lease areas do not contain any mineral leases other than the oil and gas leases.

Oil and gas wells have not been drilled on the subject land (Heylmun et al., 1965). The nearest oil and gas field is the Ferron gas field about 24 miles to the northwest. The field has produced 8,494,642 MCF (thousand cubic feet) of natural gas and 38,771 barrels of petroleum from the Ferron Sandstone as of December 1982 (DOGM, 1982). The potential for oil and gas on the lease is low.

The tar sand resource is believed to occur in the Coconino Sandstone on the Kirkwood lease and in the Black Dragon Member of the Moenkopi Formation on the Valentine lease. The Kirkwood lease is estimated to contain 100 million barrels of bitumen; the Valentine lease, 340,000 barrels.

### c. Recreation

Several forms of recreational activities take place on the leases. Opportunities include sightseeing, camping, and ORV exploration (access). Recreation use takes place year-round, with spring through fall having the highest concentration. It is estimated from visitor use trend studies that the area receives about 9,165 visitor days of use per year, or 4,290 visitors recreating in the affected area per year. This estimate is based on 2.5 persons per vehicle averaging a 12-hour visit (Hahn-O'Neill, 1984). No wilderness study areas occur on the leases (Appendix VII).

## 2. Cultural Resources

Only 15 percent of the lease area has been inventoried for cultural resources. Fourteen archeological sites have been recorded. If the area inventoried is representative of the leases, then about 101 sites would be located within the leases. About 40 percent (6) of the known sites are considered eligible for listing on the National Register of Historic Places, because of their individual characteristics. However, in the context of other nearby sites and prehistoric utilization around Tan Seep, all the sites could be considered significant for settlement pattern analysis.

## 3. Visual Resources

The objective of the visual resource evaluation and management process is to classify visual resources according to their scenic quality, the number of people who see them and their attitudes toward alteration of the landscape, distance from viewers, and the man-made intrusions present. Based on this evaluation, areas are assigned management classes. Management guidelines for each class are designed to maintain or enhance visual quality.

The scenic quality of the affected area is a Class C scenery on the Valentine lease and within Sections 3 and 4 of T. 24 S., R. 10 E., of the Kirkwood lease and a Class B scenery within Section 12 of T. 24 S., R. 9 E. on the Kirkwood lease.

In the Class C scenery, very little variation in the landform takes place. Rolling hills and flat mesas dominate this area. Soil color, when visible, and vegetation are the main contrasts in color variation. The contrasts of the dark green color of scattered pinyon-juniper areas with the flat graygreen areas of brush and grass describe the color variations.

In the Class B scenery, some variation in the landform takes place. The intensity of the gray-green carpet hue of the area attributes to the classification. Large, flat mesas are open, with grasses and brush existing. These areas have little variation of vegetation pattern and texture.

The Class B and C scenery areas receive a moderate amount of recreational use, where viewing the scenery plays an important part in the experience. The type and amount of use in the general area creates a medium sensitivity level. Also, because of the road system splitting the tract, the affected areas extend into the foreground/middleground zone. The areas are visible from these roads for a distance of 3 to 5 miles, and proposed activities could be viewed in detail.

The visual resource management (VRM) class of the affected area is a Class III in the eastern half of Section 12 of T. 24 S., R. 9 E. and the southwestern quarter of Sections 3 and 4 of T. 24 S., R. 10 E. (see Appendix IV). The remainder of the affected area is Class IV.

The leases have been divided into five critical viewing sites (see Appendix I). These sites have been established along the most heavily used travel routes within the area, and contrast ratings on each proposed phase of the project have been conducted. The objective of the contrast ratings is to provide a measure for determining if the proposed activities meet the requirements of the VRM classes, and to indicate which visual features and elements of the activities need to be modified in order to meet the VRM requirements. The specific contrast ratings for each of the proposed activities can be found in Appendix VI.

### 4. Land Use Plans

The lease areas were zoned M&G-1 (Mining and Grazing 1) by Emery County's zoning resolution of January 1984.

The MFP for the San Rafael Resource Area was completed October 16, 1979. Proposals for amending leasing categories in the plan were analyzed in the Regional Tar Sand EIS and were reviewed by the Governor for consistency with State plans. The current MFP and all proposed alternatives list the subject lease areas as open to leasing.

### 5. Socioeconomics

Periods of growth and decline in Emery County have historically been linked to the coal industry. The rapid growth of Emery's coal industry and the construction and operation of several new electrical generating plants fueled a 123 percent population growth between 1970 and 1980 (see Table 6). All of the communities in Castle Valley, which lies in northwestern Emery County, have had to accommodate this growth.

Natural growth accounted for much of the growth in the early 1970's. Even through national recessions, the area's unemployment rates have averaged under 5 percent. This low rate signifies a fully employed labor force. Because the region's labor force has been nearly fully employed, the increased employment requirements in the later 1970's has resulted in significant immigration.

The latest national recession, which has temporarily halted growth in local coal production, has led to a 45 percent reduction in mining employment between 1981 and 1984 (State of Utah, 1984a). Mining remains the largest employer (29 percent of total employment in the first quarter of 1984) and source of income. The powerplants in northern Emery County also remain a major source of local income and employment (see Table 7). These industries purchase some of their supplies locally, and those who work in these industries spend some of their income locally. The circulation of money from export industries further contributes to local income and employment. Unemployment in the county is currently among the highest in Utah. This is primarily due to large mine layoffs and the resulting downturn through the local economy.

Green River is economically separate from the communities in Castle Valley. Because of its distance from coal mining activity, it has had to accommodate little of the resulting growth and has not had to deal with any of the associated infrastructure, fiscal, or social problems. In fact, Green River's population size has not varied significantly from its existing population of 1,100 for over 30 years. The major employers in the area include mining, government, agriculture, and because of its location adjacent to I-70 and a popular boating river, tourism. Based upon the average labor force/population ratios for southeastern Utah, Green River has a labor force of 550 people (Utah, 1984a). Recent uranium mine layoffs and the resulting downturn through the local economy have resulted in relatively high unemployment rates. A conservative unemployment rate of 15 percent would imply an unemployed labor pool of 80 people (Curtis, Ken, Utah Department of Employment Security, personal communication, January 1983).

Hanksville is a small, isolated community 30 road miles south of the Kirkwood tract. The town is economically separate from the rest of Wayne County. It has few services besides several gas stations, a general store, and a restaurant. Major local employers include government, mining, and agriculture. Most of the mining jobs are outside of Wayne County. Recent layoffs in the uranium industry have had a significant impact on the community and local unemployment rates are high. Many of the available jobs are temporary, part time, and low paying.

All the communities in Castle Valley, except for Emery, more than doubled their population between 1970 and 1980. Nearly all the existing infrastructure has had to be revamped. High interest rates have discouraged housing

TABLE 6

Historical Baseline and Impact Population Projections

| | 1970 | 1980 | 1983 | 1985 | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Baseline | Added Growth | Baseline | Added Growth | Baseline | Added Growth |
| Emery County | 5,137 | 11,451 | 12,750 | 13,150 | 13,500 | | 13,800 | | 13,450 | |
| Castle Dale-Huntington CCD[1] | 2,961 | 7,836 | 8,925 | 9,210 | 9,460 | 50 | 9,660 | 180 | 9,410 | 240 |
| Castle Dale | 541 | 1,910 | 2,499 | 2,580 | 2,650 | 10 | 2,700 | 60 | 2,630 | 80 |
| Cleveland | 244 | 522 | 536 | 550 | 570 | — | 580 | 10 | 560 | 20 |
| Elmo | 141 | 300 | 357 | 370 | 380 | — | 390 | — | 380 | 10 |
| Huntington | 857 | 2,316 | 2,499 | 2,580 | 2,640 | 10 | 2,700 | 40 | 2,640 | 50 |
| Orangeville | 511 | 1,309 | 1,696 | 1,750 | 1,800 | 10 | 1,840 | 40 | 1,790 | 50 |
| Unincorporated | 667 | 1,479 | 1,339 | 1,380 | 1,420 | 20 | 1,450 | 30 | 1,410 | 30 |
| Emery-Ferron CCD[1] | 1,077 | 2,500 | 2,805 | 2,890 | 2,960 | 30 | 3,030 | 160 | 2,960 | 220 |
| Clawson | 9 | 88 | 224 | 230 | 240 | — | 240 | — | 240 | — |
| Emery | 216 | 372 | 421 | 430 | 430 | 10 | 450 | 30 | 440 | 50 |
| Ferron | 663 | 1,718 | 1,935 | 2,000 | 2,050 | 20 | 2,100 | 110 | 2,040 | 160 |
| Unincorporated | 198 | 322 | 224 | 230 | 240 | — | 240 | 20 | 240 | 20 |
| Green River CCD[1] | 1,115 | 1,099 | 1,020 | 1,050 | 1,080 | 20 | 1,110 | 120 | 1,080 | 160 |
| Green River | 969 | 956 | 877 | 900 | 930 | 20 | 950 | 100 | 930 | 140 |
| Unincorporated | 146 | 143 | 149 | 150 | 150 | — | 160 | 20 | 150 | 20 |
| Wayne County | 1,483 | 1,911 | 2,150 | 2,250 | 2,500 | 10 | 2,650 | 90 | 2,750 | 130 |
| Hanksville CCD[1] | 181 | 351 | 387 | 405 | | 10 | | 90 | | 130 |

Source: Argonne 1983; State 1984

# TABLE 7

## Personal Income and Employment
## Emery and Wayne Counties, 1982
## (By Place of Work)

| | Emery County | | Wayne County | |
|---|---|---|---|---|
| | Earnings (Percent) | Employment (Percent) | Earnings (Percent) | Employment (Percent) |
| Agriculture | a | 1 | 12 | 8 |
| TOTAL AGRICULTURE | a | 1 | 12 | 8 |
| Mining | 44 | 36 | D | D |
| Construction | 27 | 21 | D | D |
| Manufacturing | a | 1 | 3 | 6 |
| Transportation & Public Utilities | 17 | 15 | D | D |
| Wholesale Trade | 1 | 1 | 1 | 1 |
| Retail Trade | 2 | 6 | 6 | 10 |
| Finance, Insurance & Real Estate | 1 | 1 | D | D |
| Services | 2 | 6 | 6 | 6 |
| Total Private Industry | 94 | 87 | 42 | [illegible] |
| Federal Government | 1 | 2 | 20 | 21 |
| State & Local Government | 5 | 11 | 27 | 27 |
| Total Government | 6 | 13 | 47 | 48 |
| TOTAL NONAGRICULTURAL | 99 | 99 | 88 | 92 |
| Unemployment (1st Quarter, 1984) | | 12 | | 11 |
| | (Dollars) | (Jobs) | (Dollars) | (Jobs) |
| Total Employment & Earnings | $167,772,000 | 6,938 | $ 5,902,000 | 726 |
| Total Personal Income (By Place of Residence | $119,464,000 | | $13,617,000 | |
| Per Capita Personal Income | $ 8,853 | | $ 6,581 | |

Note: Because of rounding, numbers are not additive.
Total and percentage income figures include wage, salary, and proprietors' income. Total employment figures include wage, salary, and proprietors' employment, whereas the employment percentage figures include only wage and salary employment. The relative importance of farm employment is, therefore, underrated.

[a] Less than 1 percent
[D] Not shown to avoid disclosure of confidential information.

Sources: USDC, 1984; State, 1984a

construction, and coupled with rapid population growth, have resulted in a serious housing shortage. Much of the housing demand has been accommodated through mobile homes (33 percent of the housing units in Emery County are mobile homes). Housing construction has now caught up with demand, and with the existing downturn through the local economy, there is now a small excess supply of housing units (see Table 8). A recent $30 million building program has doubled the school system's carrying capacity. Except for Ferron Elementary, all schools are operating well under capacity. Water, sewer, and roads in Castle Valley are serviced by the Castle Valley Special Service District (CVSSD). The CVSSD has a special taxing jurisdiction which includes nearby powerplants, and it has therefore had significant financial resources to respond to the added infrastructural needs of Castle Valley. Cleveland's and Elmo's water system, which is not operated by CVSSD, is operating at capacity. Ferron's sewage system is operating at overcapacity; however, there are plans to correct this problem by 1985.

Because Green River has remained stable over the past 30 years, its infrastructure has had to be upgraded and expanded only as old infrastructure wore out. There is a slight excess housing and school capacity. A new water treatment plant processing Green River water is operating well under capacity. Plans have been developed for upgrading Green River's sewer system which is now operating at overcapacity.

Hanksville's infrastructure is not sufficiently developed that it could be upgraded to support a large population increase. The degree to which the existing infrastructure would need to be rebuilt would constitute the building of a new town. Although Hanksville has an apparent excess supply of housing, 39 percent of the existing housing units consist of mobile homes. Except for a small elementary school, which is operating at well undercapacity, all other school services are provided outside the impact area (western Wayne County). The town has no centralized sewer system and, although the water system has just been upgraded, the system can accommodate only another 17 connections.

The sources of revenue for Emery County and the communities in Castle Valley are well distributed (see Table 9). The powerplants and coal mines, which respectively account for 73 percent and 14 percent of the total assessed property value in the county, are an important stable source of government revenues. The communities in Castle Valley have been successful in upgrading infrastructure in response to rapid growth because (1) the CVSSD is able to tax nearby powerplants, and (2) the communities are able to cooperate and share services.

For a community of its size, Green River's sources of revenues are well distributed. However, Green River does not benefit from a special service district like CVSSD and does not have the same degree of cooperation and shared services enjoyed by communities in Castle Valley.

Wayne County is heavily dependent on federal and State transfer payments, which comprise 53 percent of the county's revenues. Because of lower than average revenues per capita, the county has had to be fiscally conservative

# TABLE 8

## Infrastructure Use Capacity and Projected Need

| | Housing (1980) | | | | Sewage Disposal (1980) | | | | Culinary Water (1983) | | | | Schools (1982) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Occupied Units | Vacant Units | Base Need | Plan Need | Pop. Served | Excess Cap. People | Base Need | Plan Need | Conn. Served | Excess Capacity Connections | Base Need | Plan Need | Enrollment Students (Teachers) | Apparent Excess Capacity Students (Teachers) | Base Need | Plan Need |
| Emery County | | | | | | | | | | | | | | | | |
| Castle Dale-Huntington CCD | 2,200 | 236 | 140 | 68 | | | | | | | | | | | | |
| Castle Dale | 542 | 80 | 59 | 23 | 4,195 | 2,805 | 205 | 92 | 692 | 1,108 | 205 | 23 | 2,986 | 878 | 273 | 130 |
| Cleveland | 147 | 9 | 8 | 4 | 536 | 864 | 249 | 74 | 1,050 | 1,250 | 209 | 28 | (128) | (9) | (11) | (5) |
| Elmo | 82 | 8 | 6 | 2 | 357 | 343 | 29 | 7 | b | b | b | b | | | | |
| Huntington | 698 | 59 | 39 | 17 | 2,499 | 501 | 137 | 59 | b | b | b | b | | | | |
| Orangeville | 367 | 30 | 40 | 17 | a | a | | | 452 | 928 | 206 | 17 | | | | |
| Unincorporated | 364 | 50 | 21 | 4 | | | | | | | | | | | | |
| Emery-Ferron CCD | 712 | 87 | 66 | 61 | | | | | | | | | c | c | c | c |
| Emery | 114 | 30 | 10 | 15 | 421 | 928 | 34 | 52 | 150 | 210 | 34 | 15 | | | | |
| Ferron | 489 | 49 | 46 | 45 | 1,935 | -900 | 160 | 156 | 537 | 1,263 | 160 | 44 | | | | |
| Unincorporated | | | 5 | | | | | | | | | | | | | |
| Green River CCD | 429 | 61 | 1 | 45 | | | | | | | | | 295 | 208 | 1 | 44 |
| Green River | 390 | 53 | -- | 40 | 877 | 673 | -- | | 475 | 462 | 5 | 44 | (19) | (10) | (—) | (2) |
| Unincorporated | 39 | 8 | 1 | 5 | | | | | | | | | | | | |
| Wayne County | | | | | | | | | | | | | 555 | 37 | 31 | 35 |
| Hanksville CCD | 151 | 31 | 31 | 36 | NA | NA | | | 48 | 17 | 31 | 36 | (33) | (10) | (1) | (1) |

[a] Orangeville and Castle Dale have a common sewage disposal system.
[b] Cleveland, Elmo, and Huntington have a common culinary water system.
[c] All of Castle Valley shares its school system.

Source: Argonne, 1984; CVSSD, 1983

and has not incurred any outstanding debt. However, due to low assessed property values and a high proportion of fixed revenues, the county has little ability to increase revenues in response to increased governmental costs.

The Utah State Planning Coordinator has developed baseline population projections for the impact area assuming that the recent recession will not permanently affect energy development in Utah (see Tables 6 and 8). The projections assume that another coal-fired plant, Hunter Unit 4, will be built, and that Emery County's coal production will reach 21.6 million tons by 1990 (Barber, Brad, Utah Office of Planning and Budget, personal communication, July 1984). Because plans for building Hunter Unit 4 have been dropped, baseline population projections are probably high. Baseline population projections for Wayne County are based on both a static agricultural sector and historical growth trends for other industries.

TABLE 9

Fiscal Profile of Emery and Wayne Counties and Select Communities of Interest (In $1,000)

| Budget Category | Emery County | Ferron | Green River | Wayne County |
|---|---|---|---|---|
| Revenue Base | | | | |
| Assessed Valuation | 233,820 | 3,377 | 2,287 | 6,682 |
| Valuation/Capita | 20.4 | 2.0 | 2.4 | 3.5 |
| Revenues | | | | |
| Property Tax | 3,265 | 57 | 65 | 97 |
| Sales | 95 | 58 | 132 | 25 |
| Federal Transfers | 492 | 8 | 6 | 164 |
| State Transfers | 505 | 9 | 8 | 287 |
| Service Charges | 49 | 160 | --- | 33 |
| Interest | 200 | --- | --- | --- |
| Miscellaneous | 1,847 | 60 | 64 | 199 |
| Total Revenues | 6,453 | 352 | 275 | 805 |
| Per Capita Revenues | .6 | .2 | .3 | .4 |
| Expenditures | | | | |
| Total Expenditures | 6,452 | 353 | 322 | 761 |
| Per Capita Expenditures | .6 | .2 | .3 | .4 |

Source: Argonne, 1983

Accelerated growth in Castle Valley has resulted in social change and loss of some lifestyle values. Immigration has brought a heterogeneous population into a previously homogeneous culture. Local governments and residents are now aware of the consequences of boom-bust growth and are wary of actions that may cause further rapid growth. Current high unemployment rates have moderated this local wariness of further growth. Local governments are learning how to plan for growth and, given adequate funding, can deal with future growth better than they have dealt with past growth.

For its size, Green River is an economically and socially diverse community. The community has not had to deal with rapid growth and has not developed the organized planning and outside linkages exhibited by Castle Valley. However, it has had to deal with outside industries and agencies with regard to several potential developments. Given the high unemployment rates, residents of Green River would be receptive to resource developments that would increase employment opportunities.

One of the major reasons for Hanksville's settlement was the area's isolated nature. The community is still isolated, with few economic and political linkages to outside communities, industries, and government agencies (DePaepe, Duane, Environmental Specialist, BLM Richfield District, Utah, personal communication, July 1984). There is little formal organization within the community; however, there has been little need to organize and exhibit coordinated planning at the community level. Except for those associated with the government, most people are long-time residents and are culturally homogeneous. High unemployment and underemployment have led to a desire for increased development and employment opportunities. There has also been a desire to decrease outside influences on the community.

## IV. ENVIRONMENTAL CONSEQUENCES

A general description of the affected environment and the environmental consequences of insitu development of tar sand within the San Rafael Swell STSA has previously been addressed in Volumes I and II of the Regional EIS (BLM, 1984). The Regional EIS identified a range of possible environmental consequences depending upon the intensity of development which varied from no action to maximum development alternative. A summary of these possible environmental consequences is given below:

Air Quality - Emissions of $SO_2$, particulate matter;

Soils - Soil erosion would increase;

Vegetation - Insitu development would cause loss of vegetation;

Water Resource - An increase in salt and sediment load of the Colorado River system would be expected;

Wildlife - The operation would cause displacement of animals;

Livestock and Agriculture - The development would cause temporary loss of forage;

Visual Resources - Development could degrade the visual quality of the landscape;

Cultural Resources - Cultural resources could be inadvertently destroyed by developmental activities and vandalism;

Recreation - Recreational users could be displaced by development;

Socioeconomics - Hanksville and Green River would receive an influx of people due to the development.

The environmental consequences of the proposed actions and alternatives are discussed separately for the Kirkwood leases and the Valentine lease. Accumulative analysis follows the separate analyses so the reader can evaluate the total impact of tar sand lease conversion and developments in the San Rafael Swell STSA.

## A. Analysis Assumptions

1. The leases would be approved in 1985.

2. Between 20 and 40 percent of the in-place bitumen would be recovered (BLM, 1983).

3. In the Alternate Technology Alternative, 5 barrels of water would be required to recover 1 barrel of bitumen (Everett, David, Supervisory Environmental Specialist, BLM Cedar City District, personal communication, June 1984).

4. An undetermined amount of subsidence could occur as the result of the extraction of the bitumen.

5. An estimated 75 percent of the leases would be disturbed to some degree over the life of the project; but, on the Kirkwood leases, no more than 375 acres are expected to be disturbed at any one time.

6. Disturbed areas would be recontoured and reclaimed as specified by the BLM.

7. Reclamation would be completed 7 years after production ceased on the Kirkwood lease, 5 years on the Valentine lease with no irrigation or other aids being used. At the end of the reclamation period, grasses would predominate.

8. The bitumen would be trucked to the Green River railhead in trucks with a capacity of 200 barrels.

9. Ground water would not be available in sufficient quantity to provide for pilot plant or production needs.

10. Water would be hauled by truck.

11. On the Valentine lease, a total of 30 truck trips would be required to haul water for the pilot plant phase and the production phase would require 2 truck trips per week.

12. On the Kirkwood leases, water requirements for the pilot plant phase would be 4.5 truck trips per week. The production phase would require 1 truck trip per day.

## B. Kirkwood Leases

### 1. Applicant's Proposed Action

### a. Natural Environment

### (1) Air Quality

Engineering technology on the pilot and production phases which govern emission resources, locations, and rates are incomplete. In the absence of detail, assumptions were made to analyze potential air quality impacts. The insitu fire flood process is a potentially high producer of hydrogen sulfide and sulfur dioxide as well as lesser amounts of particulates and nitrogen oxides associated with activities related to recovery and transport of the product. Removal of 95 percent of the hydrogen sulfide in the off-gas prior to combustion (flaring) was assumed. Control of 90 percent of the $SO_2$ produced by flaring by flue-gas desulfurization (FGD) was assumed. Ninety percent control by FGD was also assumed for the boiler. The need for a boiler was assumed for power requirements at the facility and the boiler was assumed to burn syncrude produced by the facility. Based on experience obtained at Asphalt Ridge recovering a product of similar properties, it was assumed that some upgrading of the product would have to be done in order to effectively transport the material (Green and Stevens, 1984).

Estimated air pollutant emission rates and the main sources are shown in Table 10. More detailed discussion of the assumptions made regarding emission sources, emission rates, meteorology, and atmospheric dispersion models used appears in Appendix V.

A potential emission source that cannot presently be quantified is the leakage of off-gasses produced in the combustion process up through the ground surface to the atmosphere. High localized pollutant concentrations, including hazardous levels of hydrogen sulfide, could occur if not adequately controlled. Insitu combustion oil shale development has used packing of soil surfaces and negative pressure techniques (applying a partial vacuum to the produced gas) to minimize these fugitive emissions. These methods may also be appropriate for tar sand operations.

Pollutant Concentrations. Estimated increased $SO_2$ and TSP concentrations that would be expected with implementation of the proposed action are compared to the PSD Class I and Class II increments in Table 11. The table also compares total maximum estimated concentrations for $SO_2$ and TSP to the NAAQS. Three meteorological dispersion conditions were analyzed. The first two represented stable atmospheric conditions (Pasquill E and F) with light wind conditions (2.5 meters per second or 6 mi/h). Stable atmospheric conditions associated with low wind speeds occur approximately 50 percent of the time in the region. The third condition represented a neutral atmospheric condition (D stability) with slightly higher wind speeds (4 meters per second or 9 mi/h). Neutral stability has been shown to occur 30 percent of the time in the region.

## TABLE 10

### Emission Inventory

| | Emission Rates (kg/hr) | | | | |
|---|---|---|---|---|---|
| | Part | $SO_2$ | $NO_x$ | CO | HC |
| **Point Sources** | | | | | |
| Commercial Plant | | | | | |
| Compressors | 6.4 | 59.6 | 79.6 | 19.4 | 7.2 |
| Boiler | 0.25 | 35.9 | 40.0 | 3.2 | 0.7 |
| Flare | -- | 441.9 | -- | -- | -- |
| Hydrocrocker | 4.2 | 237.0 | 2.1 | 0.4 | 36.3 |
| **Drilling Sites** | | | | | |
| Drilling Equipment | 0.15 | 0.15 | 2.25 | 0.5 | 0.2 |
| **Area Sources** | | | | | |
| Well Fugitives | -- | -- | -- | -- | 1.9 |
| Bitumen Storage | -- | -- | -- | -- | 0.1 |
| Wind Erosion | 40.4 | -- | -- | -- | -- |
| Dirt Roads | 6.0 | -- | -- | -- | -- |

Note: Best available control technology (BACT) was assumed for the emission rate estimates.

## TABLE 11

### Projected $SO_2$ and TSP Concentrations

| Location, Distance | Concentration (ug/$m^3$) | | | | | |
|---|---|---|---|---|---|---|
| | $SO_2$ | | | TSP[b] | | |
| Class II Areas | 3-Hour | 24-Hour | Annual | 1-Hour | 24-Hour | Annual |
| Allowable Increment | 512 | 91 | 20 | -- | 37 | 19 |
| Family Butte, 3.5 km | 789 | 197 | | 17.7 | 4.4 | |
| Northwest, 2.9 km | 1,022 | 256 | | 25.3 | 6.3 | |
| West Lease Boundary, 1.6 km | 1,259 | 315 | | 44.7 | 11.2 | |
| East Lease Boundary, 1.6 km | 809 | 202 | | 48.3 | 12.0 | |
| Northwest High Point, 3.9 km | 498 | 125 | | 10.3 | 2.6 | |
| Block Mountain, 8.7 km | 245 | 61 | | 5.3 | 1.3 | |
| Class I Areas | | | | | | |
| Allowable Increment | 25.0 | 5.0 | 2.0 | -- | 10.0 | 5.0 |
| Capitol Reef, 54 km | 23.1 | 5.8 | | 0.6 | 0.15 | |
| Canyonlands-Horseshoe Canyon, 61 km | 2.4* | 0.6* | | 0.07* | 0.02* | |
| Canyonlands-Cedar Mesa, 127 km | 7.9 | 2.0 | | 0.2 | 0.06 | |
| Canyonlands-Elaterite Butte, 90 km | 4.6** | 1.2** | | 0.2 | 0.05 | |
| Arches-Windows, 108 km | 1.2* | 0.3* | | 0.03* | 0.01* | |
| NAAQS | 1,300 | 365 | 80 | Primary | 260 | [illegible] |
| | | | | Secondary | 150 | [illegible] |

F, stability windspeed 2.5 m/s toward receptor for 6 hours, except
* D stability, 4.0 m/s and
** E stability, 2.5 m/s

[b] TSP concentrations result from stack emissions only; fugitive dust is not included.

The analysis indicated that Class II increments for $SO_2$ would be exceeded for both 3-hour and 24-hour averaging times. This would be due primarily to high expected $SO_2$ emission rates and complex terrain in close proximity to the proposed lease area. The TSP concentrations from stack emissions only would be within the Class II incremental limitations. During windy conditions and dry soil surfaces, suspended fugitive dusts from disturbed soil surfaces could potentially cause exceeding of the Class II limitations. Calculated TSP emissions from disturbed surfaces within the lease area are estimated to be 350 metric tons per year compared with an estimated 100 metric tons per year from compressors, boilers, flaring, drilling, and hydrocracker, etc.

Class I $SO_2$ incremental limitations could be exceeded at Capitol Reef NP which is the closest Class I area to the proposed lease area and has terrain at the same elevation as the calculated concentrations. Other Class I areas have much lower calculated concentration because of greater distance from the proposed lease. The Horseshoe Canyon location shows lower concentration largely because the terrain is below the expected plume height under stable conditions.

Visibility. An analysis was performed to assess potential visibility impacts at the closest distance in Capitol Reef NP using the EPA Visibility Workbook. The assumed emission sources and emission rates are the same as previously discussed and are shown in Appendix V. The results of the Level I screening analysis, which takes into account stable atmospheric conditions and low wind speeds indicated that adverse visibility impairment would not be expected. Calculated values for the other Class I areas would be less because of greater distances from the proposed lease area. Final determination of adversity of visibility impairment on any Class I national park is the responsibility of the National Park Service in the PSD permit review process for major emitting facilities.

Acid Deposition. Acid deposition is generally considered to be a regional, long range transport problem rather than a source specific concern from emission of $SO_2$ and $NO_x$. Soils within the area are generally alkaline and buffering capacities are generally large. As a result, adverse impacts from acid deposition are unlikely. On a broader, regional scale, certain areas, such as high elevation lakes in areas of highly crystalline soil parent material may be poorly buffered and subject to greater impacts from acid deposition. $SO_2$ and $NO_x$ emissions from this proposal would add to the regional acid deposition fluxes which appear to be adversely affecting sensitive ecosystem components such as those identified in certain areas of Colorado.

Conclusions. In the absence of detailed information on the proposed operating facilities, pollution controls, and resulting emissions, assumptions were made to develop the air quality impact assessment. In developing these assumptions, BLM has attempted to use the best available information appropriate to tar sand development technology to develop realistic parameters. Where uncertainties existed, a conservative approach was taken. The resulting analysis has shown that air quality limitations could be exceeded if leases were developed to the proposed 16,000 BPD level. Incremental limitations under the Prevention of Significant Deterioration Regulations could be exceeded in both Class I and Class II air quality areas. Based on the Level I visibility screening analysis, significant visibility impacts would not be expected.

### (2) Geology

An undetermined amount of fossils could be damaged or destroyed in areas disturbed by development. Subsidence could occur due to the extraction of the bitumen on the 2,078-acre lease.

### (3) Soils

The estimated disturbance during the exploration phase is 7 acres for access roads and drill sites. Most of this disturbance would affect shallow soils on ridges and across hillsides. The major impact on soils would be soil loss due to increased erosion. Soil losses from these disturbed areas would range from 0.5 to 5.0 tons per acre per year until vegetation is reestablished. Most of this loss would be from water erosion with some wind erosion.

The pilot plant phase of development would disturb a total of 10 acres. The major impact on soils would be soil loss due to increased erosion from the roadway, pilot plant site, and any stockpiled topsoil. Soil losses from water erosion could approach 5 tons per acre during the first year after disturbance, but would be less than 1 ton per acre per year after the first year.

The production phase would disturb a total of 1,560 acres during the 25 to 30 years of the project, but only 375 acres at any one time. The major impact on soils would be soil loss due to increased erosion from the disturbed areas and from stockpiled topsoil. Soil losses from water erosion could approach 10 tons per acre per year on steep slopes, but would be less than 5 tons per acre per year over most of the leases. Soil loss from wind erosion would be less than that for water erosion, except for stockpiled topsoil. Soil loss from nongravelly or nonstony topsoil could approach 20 tons per acre per year. Soil loss would decrease as reclamation is completed.

### (4) Vegetation

There would be a loss of 7 acres of vegetation during the exploration phase, 10 acres during the pilot plant phase and 1,560 acres would be disturbed (cumulative) during the production phase. Maximum loss of vegetation at any one time would be 375 acres.

The candidate T & E species, Cryptantha jonesiana, occurs on the leases, but a T & E inventory and the resulting mitigation measures should prevent any impacts to the species.

### (5) Wildlife

Loss of pinyon-juniper stands would remove available nesting, roosting, and perching sites for birds and cover for deer.

The production phase would account for the loss of at least 2 AUM's of wildlife forage yearly. The disturbance of 375 acres at any given time and the related facilities would probably cause mule deer and raptors to abandon habitat within the tract and in at least a one-half mile radius in the immediate vicinity of any operation.

Reclamation would allow wildlife to continue using the area after the operation is completed.

The additional 238 workers housed in the area would cause additional impacts on wildlife by increased illegal wildlife taking (Dalton, Larry, Resource Analyst, UDWR, personal communication, May 1982). UDWR personnel would present a program to all workers to discourage illegal hunting.

## b. Cultural Environment

### (1) Land Use

#### (a) Grazing

An estimated 9 to 13 AUM's would be taken out of production per year during maximum surface disturbance.

### (b) Minerals

From 48,000 to 96,000 barrels of bitumen would be recovered during the pilot plant phase with 20 to 40 million barrels (cumulative) recovered during the production phase. From 60 to 80 million barrels would be unrecoverable and would remain in place.

### (c) Recreation

The significance of impacts to recreation in the affected area would increase as the proposed actions develop toward the production phase. The increase in surface disturbance and onsite facilities would impact the visual quality of the area for sightseeing. Also increased traffic along the main routes in the affected area would raise safety problems for tourists having to negotiate between large trucks at frequent intervals.

If roads to the affected area are improved, visitor use in the area would increase. With an increase in visitor use, the type of recreation opportunities and experiences may change. The increase of 238 workers in the area would also increase recreation use.

The visual quality impact could be mitigated through the VRM standards and procedures. Interpretive sites could be developed to explain the operation to visitors, making the operation interesting instead of offensive.

### (2) Cultural Resources

Increased human activity in the area of the tar sand development may cause indirect or inadvertent destruction to cultural resources in the area around the development.

Mitigation excavations or indirect and inadvertent destruction of sites would be irretrievable resource commitments, because no further information beyond what was collected before destruction could be obtained in the future. Completion of the mitigation plan should provide more scientific knowledge of the area.

### (3) Visual Resources

Critical viewing Sites 1, 3, and 4 (see Appendix I) are within VRM Class IV. The total contrast within a Class IV area for any feature should not exceed 20. The proposed land surface features for the exploration phase as viewed from Site 4 would create a contrast score of 29. Thus, the proposed exploration activities in this area would not meet VRM standards. The District Manager would have to approve any operation which does not meet the standards.

Critical viewing Site 2 (Appendix I) is within VRM Class III. The total contrast within a Class III area for any one element should not exceed a moderate value (2x), and the total contrast rating for any feature may not exceed 16. The proposed exploration phase as viewed from Site 2 would create a contrast score of 29, with three different elements exceeding the moderate value. Also, the vegetation features total 18. Thus, the proposed exploration activities in this area would not meet the VRM standards.

The proposed pilot plant features as viewed from Site 4 would create a contrast score of 30, thus exceeding the maximum (20) by 10. Therefore, the proposed pilot activities in this area would not meet VRM Class IV standards.

The proposed pilot plant features as viewed from Site 2 would create a contrast score of 30, and the vegetation features total 20. Also, four different elements in the land surface would exceed the moderate value. Thus, the proposed pilot activities in this area would not meet the VRM standards.

The proposed production features as viewed from Sites 1, 3, and 4 would create a contrast score of 30. The vegetation features at Site 3 total 30 and at Site 4 total 27. Thus, the proposed production activities in these areas would not meet VRM standards.

The proposed production features as viewed from Site 2 would create a contrast score of 30 and the vegetation features total 27. Also, six different elements in the land surface would exceed the moderate value. Thus, the proposed production activities in this area would not meet the VRM standards.

Because the proposed activities are site specific, and because critical visual sites involved, onsite inspections would be conducted and mitigating measures developed prior to surface disturbance. At that time, the mitigated activities would be analyzed for contrast to ensure that the VRM standards are met. These onsite inspections would be carried out for each phase (exploration, pilot, production) and across all terrain involved.

Impacts after mitigation cannot be determined until specific locations and activities are identified and measures are developed to protect the visual quality of the area. It is anticipated, however, that there will be a loss of visual quality as a whole in the affected areas, even with mitigation, due to the industrialized character of the proposed actions and remoteness of the location. It is expected that the VRM standards would not be met for the 30-year life of the project even with mitigation, but the standards would be met after reclamation is completed.

### (4) Land Use Plans

The proposed use is in conformance with the amendments to the San Rafael MFP as described in the Utah Combined Hydrocarbon Leasing Regional Final EIS and Record of Decision (BLM, 1984) and has been reviewed by the Governor for consistency with State plans. The use is consistent with Emery County zoning regulations.

### (5) Socioeconomics

The material for this section was derived from the socioeconomic technical reports prepared for both the Utah Combined Hydrocarbon Leasing Regional EIS (BLM, 1984) and the Tar Sands Triangle EISs (USDI, 1984). The impact distribution was patterned after the San Rafael STSA's distribution of impacts. However, these leases are in the southernmost part of the San Rafael Swell STSA; therefore, impacts to northern Emery County are overstated, and impacts to southern Emery County and northern Wayne County are understated.

The area of socioeconomic effects of developments on the leases would be mostly confined to Emery and Wayne Counties. Hanksville and Green River have received a greater emphasis since they would be the most heavily impacted communities. The Castle Valley area received less community-specific discussion, since communities there would be affected to a lesser degree.

Table 2 shows the timing and manpower requirements for each phase of development. These direct impacts would generate indirect and induced impacts throughout the impact area. Projected population impacts and the distribution of these impacts are given in Table 6. A Denver Research Institute study concluded that a 10 percent annual rate of growth was the general threshold level at which a government's ability to meet increased service demands often breaks down. Because the ability to accommodate growth varies greatly among communities, an annual growth rate of 5 percent or more could be significant.

Under the assumed production and distribution scenario, none of the impacted communities (see Table 6) would need to accommodate a greater than 5 percent annual growth rate. The most heavily affected communities, Hanksville and Green River, would at some time need to accommodate a 4 percent and 3 percent annual growth rate, respectively. The assumed production scenario would not result in a high construction workforce relative to the operational workforce typical of large projects. Instead, growth would be gradual, with a peak workforce occurring during the long-run production. The higher wage rates typical of the mining sector would increase per capita income by $105 (1 percent higher than under baseline conditions). Although this increase at the county level is small, per capita income within the communities most affected (Hanksville and Green River) would increase significantly.

The infrastructures of most of the impacted communities are well positioned to accommodate the projected added needs (see Table 8). Based on the community facility guidelines, added growth due to development of this tract is not by itself enough to increase the needed level of law enforcement, health care, recreation, or social services.

The apparent excess capacity for housing, schools, sewage treatment, and culinary water is sufficient to accommodate added growth without any major upgrading of facilities. The exceptions are Ferron's sewage system and most of Hanksville's infrastructure. Plans for expanding Ferron's sewage treatment plant are already underway. Hanksville would need additional housing units, and possibly a centralized sewage system. Not discussed in the tables but also a constraint on growth are water supplies. Much of Castle Valley has marginal culinary water supplies. Additional municipal water can be purchased from other users, such as agriculture.

The impact area is far from major population centers, and development would affect mostly small and rural communities. The expected fiscal impacts could be similar to those experienced by many small communities faced with population growth. These problems and issues include (1) uncertainty as to eventual development, life of development, and future tax revenues; (2) constraints on interjurisdictional revenue sharing (some jurisdictions, where development is located, receive large revenue increases, while other jurisdictions bear many of the increased costs); and (3) time lag between infrastructure improvement cost and the eventual receipt of increased revenues, and the deficiency of traditional financing mechanisms to accommodate this time lag.

Under normal assessment procedures and mill levy rates, it is expected that aggregate long-term jurisdictional revenues would enable a similar or greater level of infrastructure service to be provided. The degree of fiscal problems arising in the short-run depends upon existing infrastructure conditions, the ability of local planners to deal with growth, cooperation between and within local government units, and the developer's cooperation and willingness to aid local communities in dealing with rapid growth.

Because of the low level of additional infrastructure required, the development of this tract should result in little, if any, of the impacts discussed above. Because Hanksville would require significant infrastructure improvement, and since the project is outside of the local taxing jurisdiction, some fiscal shortcomings could be expected in Hanksville. This problem could be compounded by Hanksville's relative inexperience with growth. Inability to deal with these short-run fiscal problems would result in short-run infrastructural shortages, reduced quality of life, and increased cost of living for both new and long-term residents.

Emery County's 1979 zoning resolution would require the developers to prepare a socioeconomic assessment and mitigation plan. Since the county's approval of the assessment and mitigation plan is required before issuing the necessary permits, Emery County has some control over the mitigation of local socioeconomic and fiscal impacts.

During the period of maximum surface disturbance, the two livestock operators would lose between 9 and 13 AUM's of public rangeland forage annually. If this forage is now being used, the operator's annual returns to labor and invest- ment would decrease by approximately $62 to $105. This period of maximum surface disturbance would last 10 to 15 years.

Projected economic changes in Castle Valley are less than what they experienced between 1970 and 1980 and should not significantly affect existing social conditions. Castle Valley, although once a relatively homogeneous population, has become somewhat more culturally diverse. Although they are now well aware of the problems that accompany rapid growth, they have more experience with which to deal with future growth. Because local unemployment rates are high, and the impact of developing this tract is low, development of this tract should be well received.

Green River has not had to deal with the various problems associated with rapid growth and boom-bust cycles. Given the high unemployment rates and existing infrastructure surpluses, development of this tract should be well received.

Given its isolated nature and its relatively homogenous culture, Hanksville could expect some change in their existing social conditions. However, given the degree of population growth, social changes would be small. Residents of Hanksville have often expressed a desire for greater development of their resources and greater employment opportunities. Although of all the communities impacted, Hanksville would have the greatest problems accommodating the growth, it also may be the most supportive of development.

## 2. Reduced Production Alternative

### a. Natural Environment

### (1) Air Quality

This alternative considers a production rate of 2,000 barrels per day. The air quality analysis used essentially the same basic assumptions related to location of facilities, emission sources, and meteorology. Stack parameters representative of a smaller facility were assumed. The assumptions are detailed in Appendix V.

Pollutant Emissions. Primary emission sources and calculated air pollutant emission rates are shown in Table 12. Stack parameters were adjusted from the 16,000 BPD proposed action values to accommodate the lower 2,000 BPD production level.

TABLE 12

Primary Emission Sources and Rates

| | Emission Rates (kg/hr) | | | | |
|---|---|---|---|---|---|
| Point Sources | Part | $SO_2$ | $NO_x$ | CO | HC |
| Commercial Plant | | | | | |
| Compressors | 0.8 | 7.5 | 11.2 | 2.4 | 0.9 |
| Boiler | Neg. | 4.5 | 12.8 | 0.4 | 0.1 |
| Flare | Neg. | 55.2 | Neg | Neg | Neg |
| Hydrocrocker | 0.53 | 26.9 | 4.54 | 0.27 | 0.05 |
| Drilling Equipment | 0.1 | 0.1 | 0.9 | 0.2 | 0.1 |
| Area Sources | | | | | |
| Well Fugitives | -- | -- | -- | -- | 0.4 |
| Wind Erosion | 7.0 | -- | -- | -- | -- |
| Dirt Roads | 0.3 | -- | -- | -- | -- |

Pollution Concentrations. Estimated increased $SO_2$ and TSP concentrations that would be expected with the implementation of this alternative are compared to the PSD Class I and Class II allowable increments in Table 13. The same three meteorological conditions were analyzed that were used in the 16,000 BPD proposal.

TABLE 13

Projected $SO_2$ and TSP Concentrations

| Location | Concentration (ug/m$^3$) | | | | | |
|---|---|---|---|---|---|---|
| | $SO_2$ | | | TSP$^b$ | | |
| Class II Areas | 3-Hour | 24-Hour | Annual | 1-Hour | 24-Hour | Annual |
| Allowable Increment | 512 | 91 | 20 | -- | 37 | 19 |
| Family Butte, 3.5 km | 111 | 28 | | 6.8 | 1.7 | |
| Northwest, 2.9 km | 154 | 39 | | 9.7 | 2.4 | |
| West Lease Boundary, 1.6 km | 269 | 67 | | 22 | 5.5 | |
| East Lease Boundary, 1.6 km | 227 | 57 | | 28 | 7.0 | |
| Northwest High Point, 3.9 km | 68 | 17 | | 4.0 | 1.0 | |
| Block Mountain, 8.7 km | 34 | 9 | | 2.0 | 0.5 | |
| Class I Areas | | | | | | |
| Allowable Increment | 25.0 | 5.0 | 2.0 | -- | 10.0 | 5.0 |
| Capitol Reef, 54 km | 3.7 | 0.9 | | 0.22 | 0.06 | |
| Horseshoe Canyon | 0.4* | 0.1* | | 0.03* | 0.01* | |
| Canyonlands-Cedar Mesa | 1.3 | 0.3 | | 0.08 | 0.02 | |
| Elaterite Butte | 0.08 | 0.2 | | 0.07 | 0.02 | |
| Arches-Windows | 0.02* | 0.01* | | 0.01* | 0.01* | |
| NAAQS | 1,300 | 365 | 80 | Primary | 260 | 75 |
| | | | | Secondary | 150 | 60 |

* D, 4.0 m/s, all other concentration F, 2.5 m/s

The analysis indicated that no air quality limitations would be exceeded in either the Class I or Class II areas.

Visibility. The analysis which was done for the 16,000 BPD production level indicated that adverse visibility impairment was not likely. Because this alternative is significantly lower in production level and associated visibility impairing emissions, no adverse visibility impairment would be expected.

### (2) Geology

The difference in the area disturbed at one time under the reduced production alternative would not change the overall impacts to paleontological resources. Impacts would be as described under Environmental Consequences of the Applicant's Proposed Action.

### (3) Soils

Impacts would be the same as described under Environmental Consequences of the Applicant's Proposed Action, except that 50 acres would be disturbed at any one time.

### (4) Vegetation

Impacts from the development of the Reduced Production Alternative would be similar to impacts that would result from development of the Applicant's Proposed Action, except the maximum loss of vegetation would be reduced to 50 acres at any one time.

### (5) Wildlife

Impacts from the exploration and pilot plant phases would be the same as would result from development of the Applicant's Proposed Action.

The increase in time to complete the project would cause wildlife to abandon the operation area for a much longer time.

## b. Cultural Environment

### (1) Land Use

#### (a) Grazing

An estimated 2 to 4 AUM's would be taken out of production annually during maximum surface disturbance. All other impacts would be similar to Applicant's Proposed Action.

#### (b) Minerals

The amounts of bitumen recovered and remaining in place would be the same as would result from development of the Applicant's Proposed Action.

#### (c) Recreation

Impacts to recreation use would be similar, but 78 precent less than those described under impacts of the Applicant's Proposed Action, but over 130 years instead of 30 years.

### (2) Cultural Resources

Impacts that would result from implementing the Reduced Production Alternative would be the same as would occur if the Applicant's Proposed Action were implemented.

### (3) Visual Resources

Impacts on visual quality from implementation of the Reduced Production Alternative, as well as mitigating measures and residual impacts, would be the same as would result from implementation of the Applicant's Proposed Action.

### (4) Land Use Plans

Implementation of the Reduced Production Alternative would be consistent with existing land use plans as described under Environmental Consequences of the Applicant's Proposed Action.

### (5) Socioeconomics

The reduced workforce requirements (12 percent of the requirements for the Applicant's Proposed Action would eliminate any of the potential infrastructure and fiscal problems described for the Applicant's Proposed Action. A workforce of this size would most likely be filled by existing residents. The higher paying jobs could reduce unemployment and increase per capita income, but by less than 1 percent at the county and community level.

There would be no change from baseline social conditions.

## 3. Alternate Technology Alternative

### a. Natural Environment

### (1) Air Quality

This alternative considers a steam-assisted insitu combustion operation. In addition to the emission sources assumed in the proposed action, a boiler would be necessary to produce steam for injection into the recovery area. Certain emissions, particularly $SO_2$, $NO_2$, and some particulates would be increased over those assumed in the proposed action; the extent of increase depending upon the amount of steam needed. Net pollutant emissions coming from the facility are shown in Table 14. Associated ground level pollutant concentrations are shown in Table 15. Both the 3-hour and 24-hour Class II $SO_2$ incremental limitations could be exceeded under the assumptions used. Class I $SO_2$ incremental limitations would not be exceeded.

The Level I visibility screening analysis (Tables 14 to 16) indicated that adverse visibility impairment cannot be ruled out. The $C_2$ (plume, terrain contrast) values exceed the EPA recommended guidelines when both fine, light, scattering particles and larger, less efficient, fugitive dust particles are included in the analysis. Because the larger fugitive dust particles from disturbed soil surfaces and unpaved roads would be expected to settle out close to the lease area, another analysis was done to look at visibility impacts from the stack emissions only. The resulting values (Table 16) are below the EPA guideline but not sufficiently so to completely rule out the possibility of an adverse visibility impact.

### (2) Geology

Impacts would be as described under Environmental Consequences of the Applicant's Proposed Action.

## TABLE 14

### Primary Emission Sources and Rates

| | Emission Rates (kg/hr) | | | | |
|---|---|---|---|---|---|
| Point Sources | Part | $SO_2$ | $NO_x$ | CO | HC |
| Commercial Plant | | | | | |
| Boiler | 59.04 | 438.48 | 167.40 | 20.16 | Neg. |
| Delayed coking furnace | 17.10 | 0.94 | 271.80 | 26.46 | 4.68 |
| Hydrocracker | 4.20 | 237.0 | 2.10 | 0.40 | 36.30 |
| Area Sources | | | | | |
| Well Fugitives | -- | -- | -- | -- | 1.9 |
| Bitumen Storage | -- | -- | -- | -- | 0.1 |
| Wind Erosion | 40.4 | -- | -- | -- | -- |
| Dirt Roads | 6.0 | -- | -- | -- | -- |

## TABLE 15

### Projected $SO_2$ and TSP Concentrations

| Location, Distance | Concentration ($ug/m^3$) | | | | | |
|---|---|---|---|---|---|---|
| | $SO_2$ | | | TSP | | |
| Class II Areas | 3-Hour | 24-Hour | Annual | 1-Hour | 24-Hour | Annual |
| Allowable Increment | 512 | 91 | 20 | -- | 37 | 19 |
| Family Butte, 3.5 km | 642 | 160 | | 73 | 18 | |
| Northwest, 2.9 km | 818 | 205 | | 91 | 23 | |
| West Lease Boundary, 1.6 km | 1,031 | 258 | | 30 | 7.5 | |
| East Lease Boundary, 1.6 km | 459 | 115 | | 9 | 2.3 | |
| Northwest High Point, 3.9 km | 411 | 103 | | 48 | 12 | |
| Block Mountain, 8.7 km | 200 | 50 | | 23 | 5.8 | |
| Class I Areas | | | | | | |
| Allowable Increment | 25.0 | 5.0 | 2.0 | -- | 10.0 | 5.0 |
| Capitol Reef, 54 km | 18.8 | 4.7 | | 2.2 | 0.6 | |
| Horseshoe Canyon | 1.9* | 0.5* | | 0.2* | 0.05* | |
| Canyonlands-Cedar Mesa | 6.2 | 1.6 | | 0.6 | 0.2 | |
| Elaterite Butte | 3.3** | 0.8** | | 0.3** | 0.01** | |
| Arches-Windows | 1.0* | 0.3* | | 0.1* | 0.03* | |
| NAAQS | 1,300 | 365 | 80 | Primary | 260 | 75 |
| | | | | Secondary | 150 | 60 |

* D stability, 4.0 m/s

** E stability, 2.5 m/s, all other concentrations F, 2.5 m/s.

## TABLE 16

### Level I Visibility Analysis[a]

| Observer Location | $C_1$ (Plume/Sky Contrast) | $C_2$ (Plume/Terrain Contrast) | $C_3$ (Regional Reduction in Sky/Terrain Contrast) |
|---|---|---|---|
| Capitol Reef NP (Cathedral Valley Area) | -0.0737 | 0.1212 | 0.0158 |
| Stack Emissions Only[b] | -0.0760 | 0.0841 | 0.0151 |
| Canyonlands NP (Horseshoe Canyon Unit) | -0.0499 | 0.076 | 0.0158 |
| EPA Recommended Guidelines | 0.1000 | 0.1000 | 0.1000 |

[a] Calculated using procedures from Workbook For Estimating Visibility Impairment, Latimer and Ireson, 1980.

[b] Because $C_2$ exceeded the guideline of 0.1000 at Capitol Reef NP, fugitive TSP emissions were subtracted and $C_1$ and $C_2$ recalculated for Capitol Reef. The fugitive TSP emissions are from disturbed soil surfaces and dirt roads. These particles are generally large and most would settle out near the lease area, with very few reaching Capitol Reef. In addition, these particles are much larger and have less potential to scatter light and thus impact visibility than the particles assumed in the Level I analysis.

### (3) Soils

Impacts to soils from implementing the Alternative Technology Alternative would be the same as those described for the Applicant's Proposed Action.

### (4) Vegetation

Impacts to vegetation would be as described for the Applicant's Proposed Action.

### (5) Wildlife

Impacts from implementation of the Alternative Technology Alternative would be the same as those described for the Applicant's Proposed Action.

## b. Cultural Environment

### (1) Land Use

### (a) Grazing

Impacts to livestock grazing under the Alternative Technology Alternative would be the same as those described for the Applicant's Proposed Action.

### (b) Minerals

The amounts of bitumen recovered and remaining in-place would be the same as those described for the Applicant's Proposed Action.

### (c) Recreation

Impacts to recreation use under the Alternative Technology Alternative would be similar, but 60 percent greater, than those described under the Applicant's Proposed Action.

### (2) Cultural Resources

Impacts of implementing the Alternative Technology Alternative would be similar, but up to 60 percent greater, than those that would result from implementing the Applicant's Proposed Action due to increased vandalism and collecting that would result from the increased workforce.

### (3) Visual Resources

Impacts on visual quality from implementation of the Alternative Technology Alternative would be the same as those described for the Applicant's Proposed Action.

### (4) Land Use Plans

The Alternate Technology Alternative would be consistent with existing land use plans as described in the Environmental Consequences of the Applicant's Proposed Action.

### (5) Socioeconomics

Under this alternative, the workforce requirements and, therefore, the population, income, infrastructural and fiscal impacts would be 60 percent greater than those described under the Applicant's Proposed Action. The differences would be in degree and not nature of the impacts.

A Denver Research Institute study concluded that a 10 percent annual rate of growth was the general threshold level at which a government's ability to meet increased service demands often breaks down. Because the ability to accommodate growth varies greatly among communities, an annual growth rate of 5 percent or more could also be significant. Only Hanksville would need to accommodate a greater than 5 percent annual growth rate. Hanksville would also need the greatest infrastructural improvements and would have the greatest problems providing for these additional needs.

The social impacts under this alternative would be similar to those described for the Applicant's Proposed Action with Hanksville having to accommodate the greatest social changes. The differences would not be in the nature, but the greater degree of social changes expected under this alternative.

### 4. No Action Alternative

Under the No Action Alternative, there would be no surface disturbance, no loss of paleontological resources, soil, vegetation, wildlife habitat, or forest resources. Water resources, wildlife, livestock grazing, visual quality, recreation, and cultural resources would not be impacted. Potential subsidence would not occur. The tar sand resource of 100 million barrels of bitumen would remain in-place with 20 to 40 million barrels of production being foregone or delayed. There would be no change from baseline economics, social conditions, and no new jobs would be created. Scientific knowledge from salvage of cultural sites would not be obtained. No wildlife would be displaced.

## C. Richard J. Valentine Lease

### 1. Applicant's Proposed Action

### a. Natural Environment

### (1) Air Quality

Because the production of bitumen in this alternative would be very small, the impacts would be negligible.

### (2) Geology

An undetermined amount of fossils would be damaged or destroyed in areas disturbed by development. Any fossils lost would not be recoverable.

Subsidence could occur due to the extraction of the bitumen on the 160-acre lease.

### (3) Soils

The exploration phase would disturb about 2 acres. The major impact to soils would be soil loss due to accelerated erosion from surface disturbance. This would be less than 1 ton per acre per year.

The pilot plant phase would disturb 10 acres. This would result in a soil loss of less than 1 ton per acre per year.

During the production phase, a total of 120 acres would be disturbed, but only 50 acres would be disturbed at any one time.

Soil loss from water erosion could approach 5 tons per acre per year during the first year after disturbance and then drop to less than 1 ton per acre per year. Soil loss from wind erosion would be less than that for water erosion. Soil loss would be reduced once reclamation is completed.

(d) Vegetation

Surface tar sand development by insitu methods would permanently alter existing vegetation and the potential for reclamation would be poor. There would be a loss of 2 acres of vegetation during the exploration phase, 10 acres during the pilot plant phase and 120 acres (including the previous 12 acres) in the production phase. Reclamation would allow limited reestablishment of native or exotic vegetation within 5 years after production is completed on this tract.

(5) Wildlife

The exploration drilling would not cause a substantial physical loss (only 2 acres total) of wildlife habitat.

Loss of pinyon-juniper trees would remove available nesting, roosting, and perching sites for birds.

The pilot drilling would not cause a substantial physical loss (only 10 acres total) of wildlife habitat.

The production phase would be the most detrimental. The disturbance of 120 acres and the related facilities would probably cause mule deer and raptors to abandon habitat within the tract and in at least a one-half mile radius in the immediate vicinity during operation. Reclamation would allow wildlife to continue using the area after the operation is completed.

b. Cultural Environment

(1) Land Use

(a) Grazing

Due to surface disturbance, there would be a loss of 1 AUM per 16 to 23 acres. The amount of forage for livestock could be reduced due to poor potential for reclamation. Less than 1 AUM would be lost during the exploration and pilot plant phases, and up to 7.5 AUM's lost during the production phase.

(b) Minerals

From 1,000 to 2,000 barrels of bitumen would be recovered during the pilot plant phase with 67,000 to 134,000 barrels being recovered during the production phase. During the life of the project, 68,000 to 136,000 barrels would be recovered with 204,000 to 272,000 barrels being unrecoverable and remaining in-place. The operation could interfere with the development of mining claims for the life of the operation (17 years).

### (c) Recreation

The significance of impacts to recreation in the affected area would increase as the proposed actions develop toward the production phase. The increase in surface disturbance and onsite facilities would impact the visual quality of the area. The aesthetic quality of the area (for some sightseers) would be reduced. Interpretive sites could be developed to explain the operation to visitors, making the operation interesting instead of offensive.

### (2) Cultural Resources

Increased human activity in the area as a result of the tar sand development may cause indirect or inadvertent destruction of cultural resources in the area around the development.

Mitigation excavations or indirect or inadvertent destruction of sites would be irretrievable resource commitments because no further information beyond what was collected before destruction could be obtained in the future. Completion of the mitigation plan should provide more knowledge of cultural resources in the area.

### (3) Visual Resources

All features proposed for the pilot plant phase within range of the viewing site would be within the contrast standards.

All features proposed for the production phase within range of the viewing site would be within the contrast standards for the proposed production project.

Because the proposed activities are site specific and because critical visual sites are involved, onsite inspections would be conducted and mitigating measures developed prior to surface disturbance. At that time, the mitigated activities would be analyzed for contrast to ensure that the VRM requirements are met. These onsite inspections would be carried out for each phase (exploration, pilot, production) and across all terrain involved.

Impacts after mitigation cannot be determined until specific locations and activities are identified and measures are developed to protect the visual quality of the area. It is anticipated, however, that there will be a loss of visual quality as a whole to the affected area, even with mitigation. This loss is due to the industrialized character of the proposed action and remoteness of the location. It is expected that the VRM standards would be met for the 17-year life of the project with mitigation.

### (4) Land Use Plans

The Applicant's Proposed Action and all alternatives are in conformance with all alternative amendments to the San Rafael MFP as proposed in the Utah Combined Hydrocarbon Leasing Regional Final EIS (BLM, 1984) and are consistent with State land use plans and the Emery County zoning regulations.

### (5) Socioeconomics

The pilot and production workforce requirements of fewer than 10 people would most likely be filled by existing residents. Although development of this tract could reduce unemployment and increase per capita income and increase government revenues and possibly cut costs, these changes would be imperceptible at the county, community, and industry level. Development of this tract would likewise result in no significant social changes.

## 2. No Action Alternative

Under the No Action Alternative, there would be no surface disturbance and no loss of paleontological resources, soil, vegetation, wildlife habitat, and forest resources. Wildlife, livestock grazing, visual quality, air quality, recreation, mining claims, and cultural resources would not be impacted. Potential subsidence would not occur. The tar sand resource of 340,000 barrels of bitumen would remain in-place, and 68,000 to 136,000 barrels of bitumen production would be foregone. There would be no change from baseline economic or social conditions and no new jobs would be created. Scientific knowledge from salvage of cultural sites would not be obtained.

## D. Cumulative Impact Analysis of Both Projects

This section will address the cumulative impacts of both William C. Kirkwood Oil and Gas and Richard J. Valentine's Applicant's Proposed Actions. Consequently, it represents the worst case analysis.

## 1. Natural Environment

### (a) Air Quality

Impacts to air quality would be the same as those described for the Kirkwood Applicant's Proposed Action. Incremental limitations under the Prevention of Significant Deterioration Regulations could be exceeded in both Class I and Class II air quality areas. Significant visibility impacts would not be expected.

### (b) Geology

An undetermined number of fossils could be damaged or destroyed by surface disturbance on 1,680 acres. An undetermined amount of subsidence could occur due to extraction of the bitumen on 2,238 acres.

### (c) Soils

The major impact on soils would be soil loss due to increased erosion from the disturbed areas and from stockpiled topsoil. Soil losses from water erosion could approach 10 tons per acre per year on steep slopes, but would be less than 5 tons per acre per year over most of the leases. Soil loss from wind erosion would be less than that for water erosion except for stockpiled topsoil. Soil loss from nongravelly or nonstony topsoil could approach 20 tons per acre per year. Although 1,680 acres would be disturbed over the life of the projects, only 425 acres would be disturbed at any one time. Upon completion of reclamation, soil loss would decrease as erosion rates returned to the original rates.

### (d) Vegetation

Over the life of the projects, 1,680 acres of vegetation would be destroyed but it is expected that less than 425 acres would be disturbed at any one time. The candidate T & E species, Cryptantha jonesiana, occurs on the Kirkwood leases, but an inventory and the resulting mitigation measures would probably prevent any impact to the species.

### (e) Wildlife

Disturbance on 1,680 acres would displace wildlife into surrounding areas. Illegal hunting and road kill would probably increase due to the influx of 242 workers. There would be a loss of more than 2 AUM's of wildlife forage yearly. The disturbance of 425 acres at any given time and the related facilities would probably cause mule deer and raptors to abandon habitat within the leases and in at least a one-half mile radius in the immediate vicinity of any operation. Reclamation would allow wildlife to continue using the area after the operations are completed.

## 2. Cultural Environment

### (a) Land Use

### (1) Grazing

An estimated 9 to 16 AUM's of forage would be lost per year during maximum surface disturbance.

### (2) Minerals

Development of mining claims on the Valentine lease could be adversely affected for the life of the project. From 20,068,000 to 40,136,000 barrels of bitumen would be recovered with 60,204,000 to 80,272,000 barrels being unrecoverable and remaining in-place.

### (3) Recreation

Driving for pleasure and sightseeing on and near the leases would be adversely affected by increased truck traffic and visual impacts resulting from industrialization of a previously undisturbed area. The increase in 242 workers in the area would increase recreation use. As roads in the leases are improved, the visitor use in the area would increase.

### (b) Cultural Resources

Increased vandalism to archaeological sites would occur with the increase in population. Scientific knowledge would be obtained from the salvage of any cultural sites found on the leases.

### (c) Visual Resources

Impacts after mitigation cannot be determined until specific locations and activities are identified and mitigating measures are developed to protect the visual quality of the area. It is anticipated, however, that there would be a loss of visual quality, as a whole, on the affected 2,038 acres, even with mitigation, due to the industrialized character of the proposed actions and the remoteness of the location. It is expected that VRM standards would be met for the 17-year life of the Valentine project, but would not be met for the 30-year life of the Kirkwood project, even with mitigation. Reclamation would restore the land such that it meets VRM standards.

### (d) Socioeconomics

The projects during peak production would require 242 workers. Socioeconomic impacts would be as described in Environmental Consequences section under Kirkwood's Applicant's Proposed Action because the addition of four workers required for the Valentine project would have negligible impacts.

## V. CONSULTATION AND COORDINATION

### A. Agencies and Individuals Consulted

Mark Green, Air Quality Specialist, BLM Vernal District Office, regarding impacts on air quality.

Robert Montgomery, William C. Kirkwood Oil and Gas, Casper, Wyoming, regarding the Kirkwood Plan of Operations.

U.S. Fish and Wildlife Service, threatened and endangered plant species.

Mike Schwinn, Utah Division of Wildlife Resources, Vernal, threatened and endangered animal species and wildlife in general.

Bill Wagner, Natural Resource Specialist, BLM Utah State Office, regarding impacts on air quality.

### B. Public Comment

A 30-day public comment period will be held on this Draft Environmental Assessment.

## VI. PARTICIPATING STAFF

Person - Position - Assigned Resources - Education - Experience

T. Jeff Carroll - Wildlife Biologist - Wildlife - B.S. Wildlife and Botany - 5 years, BLM; 1 year, Forest Service.

Les Dobson - Hydrologist - Air Quality, Climate - B.S. Watershed Science - 3 years, BLM; 1 year, various agencies.

Larry Eyre - Chief, Lands and Minerals Staff - Reviewer - B.S. Botany - 9 years, BLM; 10 years, Utah Division of Wildlife Resources.

Martha Hahn-O'Neill - Outdoor Recreation Planner - Recreation, Visual Resources, Wilderness - A.A. Recreation Education, B.A. Forestry and Outdoor Recreation, M.S. Outdoor Recreation - 4 years, BLM

David Hansen - Soils Scientist - Soils - B.A. Economics, M.S. Soils Science - 5 years, BLM.

Laurelle Hughes - Realty Specialist - Realty, Land Use - Business - 5 years, BLM.

Ann Lambertsen - Editorial Assistant/Stenographer - Typist - # - 8 years, BLM.

Blaine Miller - Archaeologist - Cultural Resources - B.S. History, M.A. Archaeology - 10 years, BLM.

Robert Milton - Regional Economist - Socioeconomics - M.S. Economics - 3 years, BLM.

Lavonne Parks - Mail and File Clerk - Typist - # - 9 years, BLM.

Jesse Purvis - Hydrologist - Forestry, Water Resources - B.S. Fisheries, M.A. Biological Sciences - 5 years, BLM; 2 years, State of California.

Neil Simmons - Geologist - Team Leader, Geology, Minerals, Paleontology, Topography - B.S. Geological Engineering - 6 years, BLM; 5 years, Bureau of Mines.

Ruth Thurston - Writer/Editor - Editor - Business - 6 years, BLM; 15 years, private industry.

Sherilyn Van Otten - Clerk Typist - Typist - # - 1 year, BLM.

Don Wilbur - Range Conservationist - Range, Vegetation - B.A. Range Management - 12 years, BLM; 8 years, State of California.

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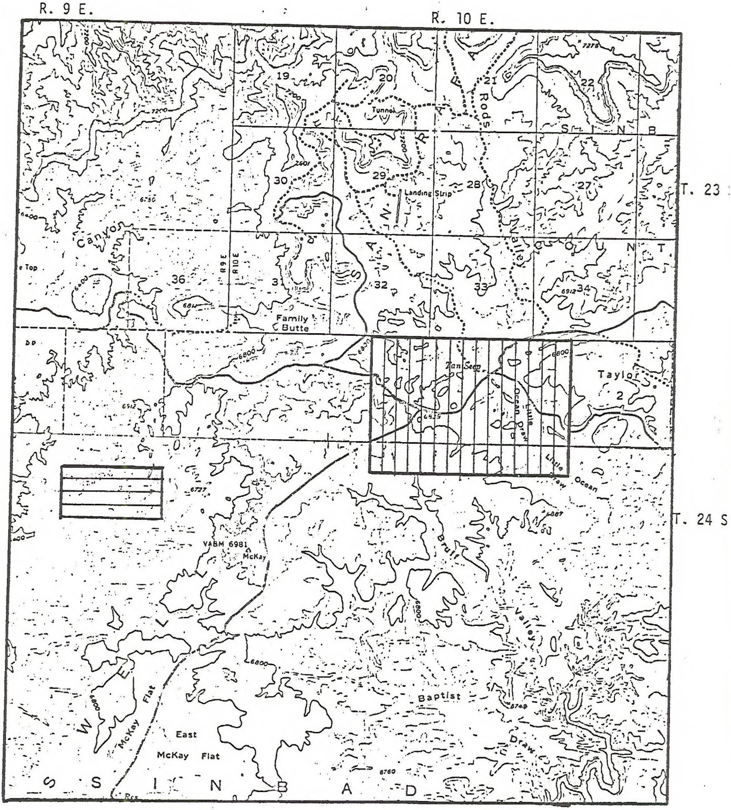
# APPENDIX I

# MAPS

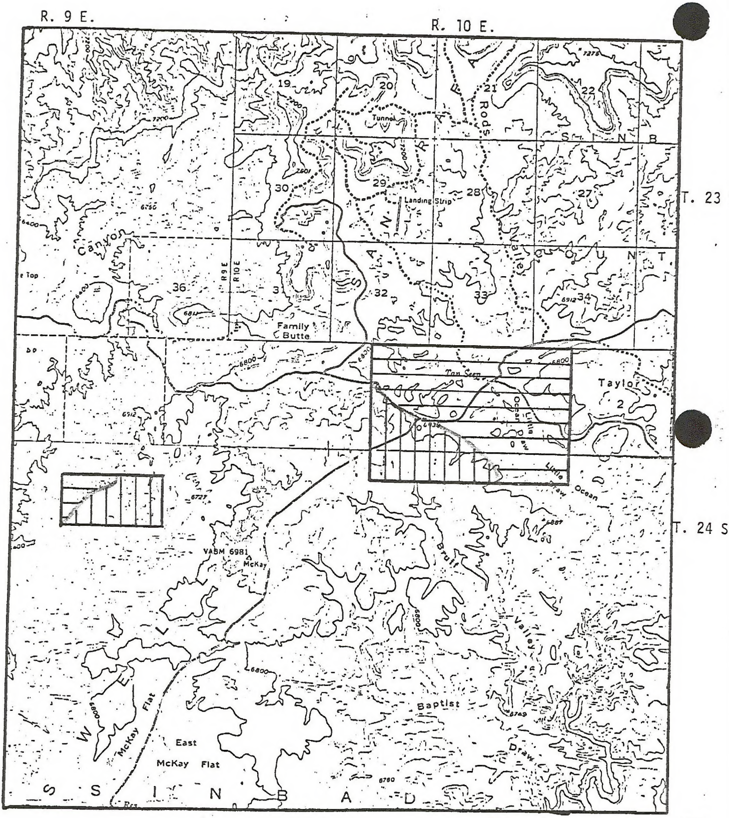


Map 1.

William C. Kirkwood Lease

▤ Class B scenery

▥ Class C scenery

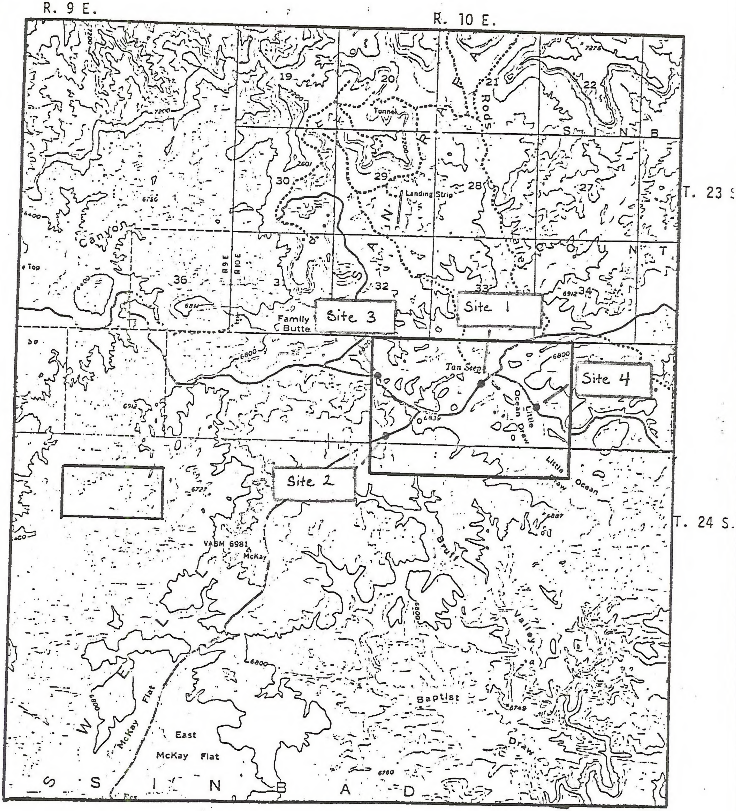


Map 2

William C. Kirkwood Lease

▥ VRM Class III

▤ VRM Class IV



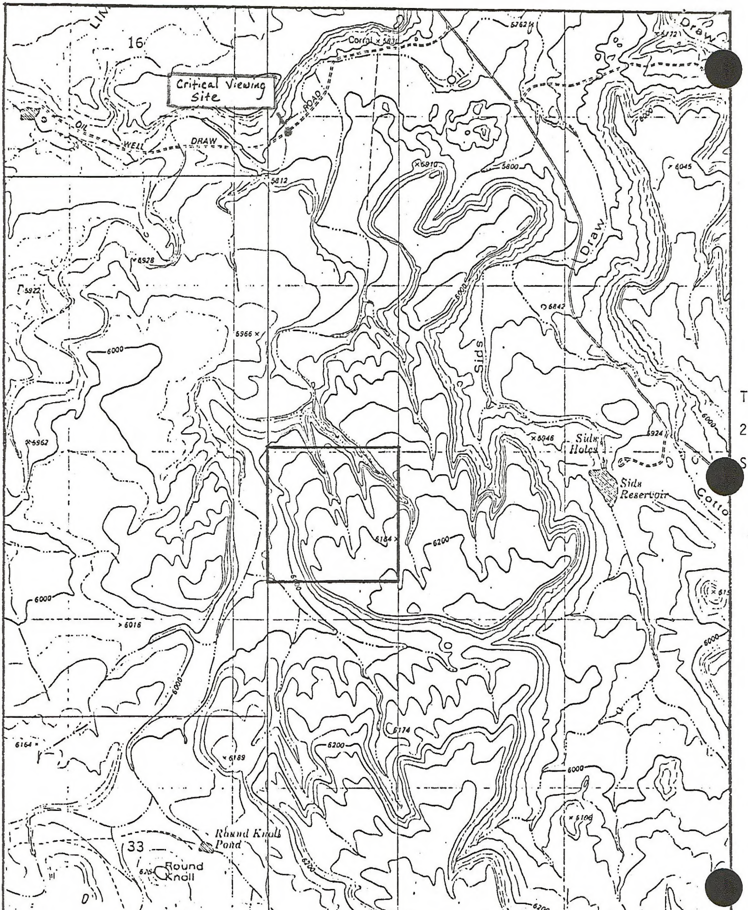
Map 3

William C. Kirkwood Lease

Critical Visual Areas

# Critical Visual Areas

R. 11 E.



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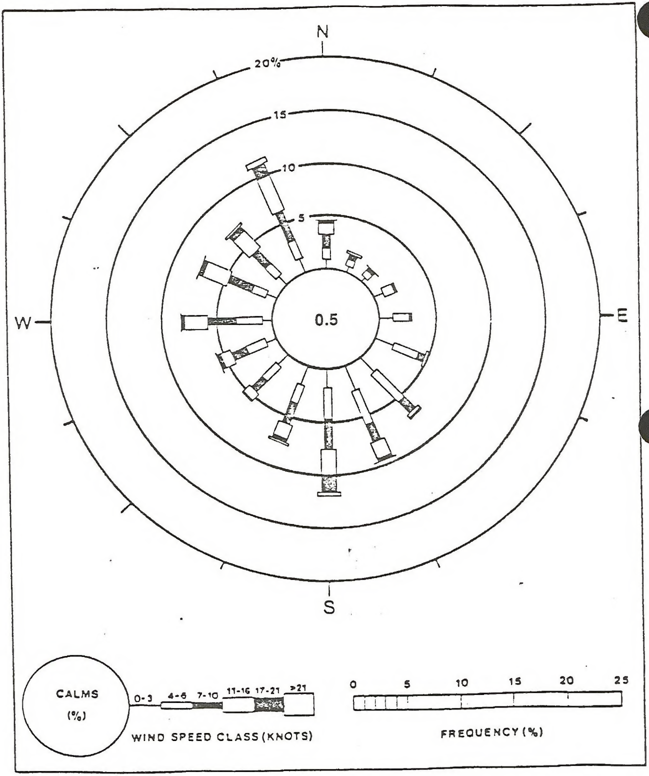
Map 4
Richard Valentine Lease

# APPENDIX II



Annual Wind Rose for Cedar Mountain (1/80 - 12/81)

# APPENDIX III

## VEGETATION COMMUNITIES

| Site | Existing Species | Percent Composition by Weight |
|---|---|---|
| Kirkwood Leases | | |
| Pinyon-Juniper (680 Acres) | | |
| | Pinus edulis | 40 |
| | Juniperus occidentalis | 45 |
| | Artemisia pygmaea | 10 |
| | Artemisia arbuscula | Trace |
| | Ephedra torreyana | 1 |
| | Elymus salinus | Trace |
| | Gutierrezia sarothrae | 2 |
| | Amelanchier utahensis | Trace |
| Grass (80 Acres) | | |
| | Bouteloua gracilis | 48 |
| | Gutierrezia sarothrae | 40 |
| | Artemisia frigida | 5 |
| | Orysopsis hymenoides | 5 |
| | Hilaria jamesii | 2 |
| | Stipa comata | Trace |
| | Astragalus rafaelensis | Trace |
| | Atriplex confertifolia | Trace |
| | Eurotia lanata | Trace |
| Sagebrush (50 Acres) | | |
| | Artemisia tridentata | 55 |
| | Chrysothamnus spp. | 44 |
| | Bromus tectorum | 1 |
| Desert Shrubs (1,268 Acres) | | |
| | Artemisia pygmaea | 2 |
| | Glossopetalon spinescens | 3 |
| | Ephedra torreyana | Trace |
| | Sitanion hystrix | Trace |
| | Stipa comata | Trace |
| | Oryzopsis hymenoides | 1 |
| | Atriplex confertifolia | 1 |
| | Artemisia arbuscula | 5 |
| | Eurotia lanata | Trace |
| | Petradoria pumila | 70 |
| | Hymenoxys acaulis | 15 |

Valentine Lease

Pinyon-Juniper-Shrub (160 Acres)

| | |
|---|---|
| Pinus edulis | 30 |
| Juniperus occidentalis | 40 |
| Atriplex confertifolia | 10 |
| Hilaria jamesii | 10 |
| Oryzopsis hymenoides | 5 |
| Various Forbs | 5 |

# APPENDIX IV

## VISUAL RESOURCE MANAGEMENT CLASSES

| VRM CLASS | |
|---|---|
| II | Changes in any of the basic elements (form, line, color, and texture) caused by a management activity should not be evident in the characteristic landscape. A contrast may be seen, but should not attract attention. |
| III | Contrasts to the basic elements (form, line, color, and texture) caused by a management activity may be evident and begin to attract attention in the characteristic landscape. However, the changes should remain subordinate to the existing characteristic landscape. |
| IV | Contrasts may attract attention and be a dominant feature of the landscape in terms of scale; however, the change should repeat the basic elements (form, line, color, and texture) inherent in the characteristic landscape. |
| V | Change is needed or change may add acceptable visual variety to an area. This class applies to areas where the natural character has been disturbed to a point where rehabilitation is needed to bring it back into character with the surrounding landscape. It should be considered an interim or short-term classification until one of the other VRM class objectives can be reached through rehabilitation or enhancement. |

### Landscape Description - Kirkwood Leases

Form of the affected area ranges from simple slopes, rough-legged tables, to a mix of minor and moderate drainages. Form becomes strong with increased slopes in the foreground and middleground. Line is dominant with vegetation variation and rugged slope differences. Drainage cuts create distinct differences in line, with simple slopes becoming rough-legged tables. Texture varies from rough to smooth, intermixing from foreground to middleground. Vegetation is mostly grass and brush, with moderate to dense stands of pinyon and juniper trees covering the higher table areas. One wood fence corral, a line shack, several range fences, and several road signs and culverts exist within the affected area.

### Landscape Description - Valentine Lease

Form is weak within the area and includes simple slopes and flat views. Line is dominant where flat to rolling terrain meets the open skyline. Vegetation variation is present only in the upper reaches where line contrasts are formed. The visual texture is one of soft and smooth, with light playing an important part. Vegetation is mostly grass and brush, with moderate to dense stands of pinyon and juniper trees covering the higher mesas. There are no structures within the affected area.

# APPENDIX V

# AIR QUALITY

## TABLE 4

Level I Visibility Analysis[a]

| Observer Location | $\underline{C_1}$ (Plume Contrast Against Sky) | $\underline{C_2}$ (Plume Contrast Against Dark Terrain) | $\underline{C_3}$ (Regional Reduction in Sky/Terrain Contrast) |
|---|---|---|---|
| Capitol Reef NP[b] | -0.0225 | 0.0548 | 0.0167 |
| EPA Recommended | 0.1000 | 0.1000 | 0.1000 |

Guidelines

[a] Calculated using procedures from Workbook For Estimating Visibility Impairment, Latimer and Ireson, 1980.

[b] Calculated at the closest location in Capitol Reef to the proposed lease area. This is in the Cathedral Valley area.

The dispersion model, Complex I, was used to estimate maximum ground level impacts for TSP and $SO_2$. Because high terrain features extending above plume height are located near the proposed lease area, stable conditions (F stability) with light wind speeds (2.5 meters per second) were chosen to assess maximum class II impacts. Impacts to Capitol Reef NP, a class I area would also be maximized under these conditions due to high terrain features in the northern (and closest) portion of the park. Slightly stable (E stability) and neutral (D stability) conditions were also modeled, primarily to consider impacts to Arches and Canyonlands NPs, which are generally lower in elevation than the proposed lease area.

Because the proposed project is in the early stages of planning, it was felt that a screening analysis was appropriate. Complex I was run, assuming that the wind direction was directly toward each receptor for 6 hours in a 24-hour period. For comparison of impacts to 3-hour standards, it was assumed that the sources impacted the receptors for the entire 3-hour period.

A Level I visibility analysis was done to consider possible visibility impairment to class I areas (Capitol Reef, Canyonlands, and Arches NPs). Because the proposed action passed the level I analysis at the class I areas, further analysis was not necessary. The analysis followed the procedures described in the "Workbook for Estimating Visibility Impairment" prepared for the U.S. E.P.A. by Systems Applications, Incorporated, 1980. The calculations are included below.

## Level I Visibility - Applicant's Proposed Action

## San Rafael TSP Emissions

| | |
|---|---|
| Stack emissions = 3.19 g/s = | 0.276 metric tons/day |
| Disturbed areas | 0.970 metric tons/day |
| Unpaved roads | 0.144 metric tons/day |
| | 1.390 metric tons/day |

$SO_2$ Stack Emission = 215.19 g/s = 18.59 metric tons/day

X = 46 Km to Capitol Reef     Rvo = 170 Km     $\frac{X}{rvo} = 0.2706$

$Q_{part} = 1.390$     Te = 75 m

$QNO_x = 2.975$     $P = \frac{2.0 \times 10^8}{TEX} = 5.797 \times 10^4$

$QSO_2 = 18.592$

$T_{part} = 10.10^{-7} pQpart = 8.058 \times 10^{-2}$     $Tpart - TNO_2 = 10.99 \times 10^{-2} = .1099 = 0.11$

$TNO_2 = 1.7 \times 10^{-7} pQNO_x = 2.932 \times 10^{-2}$

$Taerosol = (1.06 \times 10^{-5})(rvo)(Qpart + 1.31\ QSO_2) = 4.639 \times 10^{-2}$

$$C_1 = \frac{TNO_2}{Tpart + TNO_2} (1 - \exp(- Tpart - TNO_2)) (\exp(-0.78 \frac{X}{r_{vo}})) =$$
$$-(.2666)(0.1041)(0.8097)$$

$C_1 = \underline{\underline{-0.0225}}$

$$C_2 = (1-(\frac{1}{C_1 + 1}) \exp(-Tpart - TNO_2)) (\exp(-1.56 \frac{X}{r_{vo}})) =$$
$$(1-(1.0230)(0.8958)) ((0.6556))$$

$C_2 = \underline{\underline{0.0548}}$

$C_3 = 0.368(1- \exp(-Toersol))$
$C_3 = \underline{\underline{0.0167}}$

## Kirkwood Alternative Technology Alternative

### Level I - VIS

Disturbed areas = 0.970 metric tons/day

Unpaved roads = 0.144 metric tons/day

Stock emissions - 22.35 g/s = 1.931 metric tons/day

Total = 3.045 metric tons/day

Q part = 3.045

Q $NO_x$ = 10..591 metric tons/day

Q $SO_2$ = 16.235 metric tons/day

X = 46 Km to Capitol Reef    Rvo = 170 Km    $\frac{X}{rvo} = 0.2706$

Te = 75 m    $P = \frac{2.0 \times 10^8}{TEX} = 5.797 \times 10^4$

$T_{part} = 10.10^{-7} pQpart = 0.1765$

$T\ NO_x = 1.7 \times 10^{-7} pQNO_x = 0.1044$

$Tpart + TNO_x = 0.2809$

$Taerosol = (1.06 \times 10^{-5})(rvo)(Qpart + 1.31\ QSO_2) = 0.04381$

$$C_1 = \frac{-TNO_x}{TNO_x + Tpart}\ (1-\exp(-TNO_2-Tpart))\ (\exp(-0.78\ \underline{\ X\ })) =$$
$$-0.3717\ (0.2449)(0.8097)$$

$C_1 = \underline{\underline{-0.0737}}$

$$C_2 = (1-(\frac{1}{C_1 + 1})\ \exp(-Tpart - TNO_2))\ (\exp(-1.56\ \frac{X}{r_{vo}})) =$$
$$(1-(\frac{1}{0.9263})(0.7551))(0.6556)$$

$C_2 = \underline{\underline{0.1212}}$

$C_3 = 0.368(1-\exp(-Taerosol))$    $Taerosol = 0.04381$

$C_3 = \underline{\underline{0.0158}}$

## Kirkwood Alternate Technology Alternative

## Level 1 - Stack Emissions Only

$Qp = 1.931$ $\quad\quad\quad$ $Tpart = 0.1119$

$$C_1 = \frac{-0.1044}{-0.1044 + 0.1119} (1-\exp(-0.1044 - 0.1119)) (0.8097)$$

$$C_1 = -0.4827 (0.1945)(0.8097)$$

$$C_1 = \underline{\underline{-0.0760}}$$

$$C_2 = (1-(\frac{1}{C_1 + 1})(\exp(-Tpart - TNO_2)) (\exp(-1.56 \frac{X}{rvo}))$$

$$C_2 = \underline{\underline{0.0841}}$$

$C_3 = 0.368 (1-\exp(-Taerosol))$ $\quad\quad\quad$ $Taerosol = 0.04180$

$$C_3 = \underline{\underline{0.0151}}$$

# APPENDIX VI

# CONTRAST RATINGS

Visual Resources
M. G. Hahn-O'Neill
Kirkwood Tract

CONTRAST RATING: Site 1 - Exploration (proposed)

| Land Surface | Element | Contrast | Score | Maximum Score Possible |
|---|---|---|---|---|
| Features | Form - | 4 X 0 = | 0 | |
| | Line - | 3 X 0 = | 0 | |
| | Color - | 2 X 0 = | 0 | |
| | Texture - | 1 X 0 = | 0 | |
| | | Subtotal = | 0 | 30 |
| Vegetation | | | | |
| Features | Form - | 4 X 0 = | 0 | |
| | Line - | 3 X 0 = | 0 | |
| | Color - | 2 X 0 = | 0 | |
| | Texture - | 1 X 0 = | 0 | |
| | | Subtotal = | 0 | 30 |
| Structures | | | | |
| Features | | | | |
| | form - | 4 X 0 : | 0 | |
| | Line - | 3 X 0 : | 0 | |
| | Color - | 2 X 0 : | 0 | |
| | Texture - | 1 X 0 : | 0 | |
| | | = | 0 | |
| | | Subtotal = | 0 | 30 |
| | | Total - | 0 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

Visual Resources
M. G. Hahn-O'Neill
Kirkwood Tract

CONTRAST RATING: Site 2 - Exploration (proposed)

| Land Surface | Element | Contrast | Score | Maximum Score Possible |
|---|---|---|---|---|
| Features | Form - | 4 X 3 = | 12 | |
| | Line - | 3 X 3 = | 9 | |
| | Color - | 2 X 3 = | 6 | |
| | Texture - | 1 X 2 = | 2 | |
| | | Subtotal = | 29 | 30 |
| Vegetation | | | | |
| Features | Form - | 4 X 2 = | 8 | |
| | Line - | 3 X 2 = | 6 | |
| | Color - | 2 X 1 = | 2 | |
| | Texture - | 1 X 1 = | 1 | |
| | | Subtotal = | 18 | 30 |
| Structures | | | | |
| Features | form - | 4 X 0 = | 0 | |
| | Line - | 3 X 0 = | 0 | |
| | Color - | 2 X 0 = | 0 | |
| | Texture - | 1 X 0 = | 0 | |
| | | = | 0 | |
| | | Subtotal = | 0 | 30 |
| | | Total = | 47 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

CONTRAST RATING: Site 3 Exploration (proposed)

| Land Surface | Element | Contrast | Score | Maximum Score Possible |
|---|---|---|---|---|
| Features | Form - | 4 X 1 = | 4 | |
| | Line - | 3 X 1 = | 3 | |
| | Color - | 2 X 1 = | 2 | |
| | Texture - | 1 X 1 = | 1 | |
| | | Subtotal = | 10 | 30 |
| Vegetation | | | | |
| Features | Form - | 4 X 2 = | 8 | |
| | Line - | 3 X 2 = | 6 | |
| | Color - | 2 X 2 = | 4 | |
| | Texture - | 1 X 2 = | 2 | |
| | | Subtotal = | 20 | 30 |
| Structures | | | | |
| Features | | | | |
| | form - | 4 x 0 = | 0 | |
| | Line - | 3 x 0 = | 0 | |
| | Color - | 2 x 0 = | 0 | |
| | Texture - | 1 x 0 = | 0 | |
| | | = | | |
| | | Subtotal = | 0 | 30 |
| | | Total = | 30 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

Visual Resources
M. G. Hahn-O'Neill
Kirkwood Tract

CONTRAST RATING: Site 4 Exploration (proposed)

| Land Surface | Element | Contrast | | Score | Maximum Score Possible |
|---|---|---|---|---|---|
| Features | Form - | 4 X 3 | = | 12 | |
| | Line - | 3 X 3 | = | 9 | |
| | Color - | 2 X 3 | = | 6 | |
| | Texture - | 1 X 2 | = | 2 | |
| | | Subtotal | = | 29 | 30 |
| Vegetation | | | | | |
| Features | Form - | 4 X 2 | = | 8 | |
| | Line - | 3 X 2 | = | 6 | |
| | Color - | 2 X 1 | = | 2 | |
| | Texture - | 1 X 1 | = | 1 | |
| | | Subtotal | = | 17 | 30 |
| Structures | | | | | |
| Features | form - | 4 x 0 | = | 0 | |
| | Line - | 3 x 1 | = | 3 | |
| | Color - | 2 x 0 | = | 0 | |
| | Texture - | 1 x 0 | = | 0 | |
| | | Subtotal | = | 3 | 30 |
| | | Total | = | 49 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

CONTRAST RATING: Site 1 - Pialt (proposed)

| Land Surface | Element | Contrast | | Score | Maximum Score Possible |
|---|---|---|---|---|---|
| Features | Form - | 4 X 0 | = | 0 | |
| | Line - | 3 X 0 | = | 0 | |
| | Color - | 2 X 0 | = | 0 | |
| | Texture - | 1 X 0 | = | 0 | |
| | | Subtotal | = | 0 | 30 |
| **Vegetation** | | | | | |
| Features | Form - | 4 X 0 | = | 0 | |
| | Line - | 3 X 0 | = | 0 | |
| | Color - | 2 X 0 | = | 0 | |
| | Texture - | 1 X 0 | = | 0 | |
| | | Subtotal | = | 0 | 30 |
| **Structures** | | | | | |
| Features | | | | | |
| | form - | 4 X 0 | = | 0 | |
| | Line - | 3 X 0 | = | 0 | |
| | Color - | 2 X 0 | = | 0 | |
| | Texture - | 1 X 0 | = | 0 | |
| | | Subtotal | = | 0 | 30 |
| | | Total | = | 0 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

Visual Resources
M. G. Hahn-O'Neill
Kirkwood Tract

CONTRAST RATING: Site 2 - Pilot (proposed)

| Land Surface | Element | Contrast | | Score | Maximum Score Possible |
|---|---|---|---|---|---|
| Features | Form - | 4 X 3 | = | 12 | |
| | Line - | 3 X 3 | = | 9 | |
| | Color - | 2 X 3 | = | 6 | |
| | Texture - | 1 X 3 | = | 3 | |
| | | Subtotal | = | 30 | 30 |
| Vegetation | | | | | |
| Features | Form - | 4 X 2 | = | 8 | |
| | Line - | 3 X 2 | = | 6 | |
| | Color - | 2 X 2 | = | 4 | |
| | Texture - | 1 X 2 | = | 2 | |
| | | Subtotal | = | 20 | 30 |
| Structures | | | | | |
| Features | | | | | |
| | form - | 4 X 0 | = | 0 | |
| | Line - | 3 X 0 | = | 0 | |
| | Color - | 2 X 0 | = | 0 | |
| | Texture - | 1 X 0 | = | 0 | |
| | | Subtotal | = | 0 | 30 |
| | | Total | = | 50 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

CONTRAST RATING: Site 3 - Pilot (proposed)

| Land Surface | Element | Contrast | | Score | Maximum Score Possible |
|---|---|---|---|---|---|
| Features | Form - | 4 X 0 | = | 0 | |
| | Line - | 3 X 0 | = | 0 | |
| | Color - | 2 X 0 | = | 0 | |
| | Texture - | 1 X 0 | = | 0 | |
| | | Subtotal | = | 0 | 30 |
| **Vegetation** | | | | | |
| Features | Form - | 4 X 0 | = | 0 | |
| | Line - | 3 X 0 | = | 0 | |
| | Color - | 2 X 0 | = | 0 | |
| | Texture - | 1 X 0 | = | 0 | |
| | | Subtotal | = | 0 | 30 |
| **Structures** | | | | | |
| Features | form - | 4 X 0 | : | 0 | |
| | Line - | 3 X 0 | : | 0 | |
| | Color - | 2 X 0 | : | 0 | |
| | Texture - | 1 X 0 | : | 0 | |
| | | | = | | |
| | | Subtotal | = | 0 | 30 |
| | | Total | = | 0 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

CONTRAST RATING: Site 4 - Pilot (proposed)

| Land Surface | Element | Contrast | | Score | Maximum Score Possible |
|---|---|---|---|---|---|
| Features | Form - | 4 X 3 | = | 12 | |
| | Line - | 3 X 3 | = | 9 | |
| | Color - | 2 X 3 | = | 6 | |
| | Texture - | 1 X 3 | = | 3 | |
| | | Subtotal | = | 30 | 30 |
| **Vegetation** | | | | | |
| Features | Form - | 4 X 2 | = | 8 | |
| | Line - | 3 X 2 | = | 6 | |
| | Color - | 2 X 1 | = | 2 | |
| | Texture - | 1 X 1 | = | 1 | |
| | | Subtotal | = | 17 | 30 |
| **Structures** | | | | | |
| Features | | | | | |
| | form - | 4 X 0 | = | 0 | |
| | Line - | 3 X 1 | = | 3 | |
| | Color - | 2 X 0 | = | 0 | |
| | Texture - | 1 X 0 | = | 0 | |
| | | Subtotal | = | 3 | 30 |
| | | Total | = | 50 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

CONTRAST RATING: Site 1 - Production (proposed)

| Land Surface | Element | Contrast | | Score | Maximum Score Possible |
|---|---|---|---|---|---|
| Features | Form - | 4 X 3 | = | 12 | |
| | Line - | 3 X 3 | = | 9 | |
| | Color - | 2 X 3 | = | 6 | |
| | Texture - | 1 X 3 | = | 3 | |
| | | Subtotal | = | 30 | 30 |
| **Vegetation** | | | | | |
| Features | Form - | 4 X 2 | = | 8 | |
| | Line - | 3 X 2 | = | 6 | |
| | Color - | 2 X 1 | = | 2 | |
| | Texture - | 1 X 1 | = | 1 | |
| | | Subtotal | = | 17 | 30 |
| **Structures** | | | | | |
| Features | form - | 4 X 1 | = | 4 | |
| | Line - | 3 X 1 | = | 3 | |
| | Color - | 2 X 0 | = | 0 | |
| | Texture - | 1 X 1 | = | 1 | |
| | | Subtotal | = | 8 | 30 |
| | | Total | = | 55 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

Visual Resources
M. G. Hahn-O'Neill
Kirkwood Tract

CONTRAST RATING: Site 2 - Production (proposed)

| Land Surface | Element | Contrast | | Score | Maximum Score Possible |
|---|---|---|---|---|---|
| Features | Form - | 4 X 3 | = | 12 | |
| | Line - | 3 X 3 | = | 9 | |
| | Color - | 2 X 3 | = | 6 | |
| | Texture - | 1 X 3 | = | 3 | |
| | | Subtotal | = | 30 | 30 |
| **Vegetation** | | | | | |
| Features | Form - | 4 X 3 | = | 12 | |
| | Line - | 3 X 3 | = | 9 | |
| | Color - | 2 X 2 | = | 4 | |
| | Texture - | 1 X 2 | = | 2 | |
| | | Subtotal | = | 27 | 30 |
| **Structures** | | | | | |
| Features | form - | 4 x 0 | : | 0 | |
| | Line - | 3 x 0 | : | 0 | |
| | Color - | 2 x 0 | : | 0 | |
| | Texture - | 1 x 0 | : | 0 | |
| | | Subtotal | = | 0 | 30 |
| | | Total | = | 57 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

CONTRAST RATING: Site 3 - Production (proposed)

| Land Surface | Element | Contrast | | Score | Maximum Score Possible |
|---|---|---|---|---|---|
| Features | Form - | 4 X 3 | = | 12 | |
| | Line - | 3 X 3 | = | 9 | |
| | Color - | 2 X 3 | = | 6 | |
| | Texture - | 1 X 3 | = | 3 | |
| | | Subtotal | = | 30 | 30 |
| **Vegetation** | | | | | |
| Features | Form - | 4 X 3 | = | 12 | |
| | Line - | 3 X 3 | = | 9 | |
| | Color - | 2 X 3 | = | 6 | |
| | Texture - | 1 X 3 | = | 3 | |
| | | Subtotal | = | 30 | 30 |
| **Structures** | | | | | |
| Features | | | | | |
| | form - | 4 x 0 | = | 0 | |
| | Line - | 3 x 0 | = | 0 | |
| | Color - | 2 x 0 | = | 0 | |
| | Texture - | 1 x 0 | = | 0 | |
| | | | = | | |
| | | Subtotal | = | 0 | 30 |
| | | Total | - | 60 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

CONTRAST RATING: Site 4 ÷ Production (proposed)

| Land Surface | Element | Contrast | | Score | Maximum Score Possible |
|---|---|---|---|---|---|
| Features | Form - | 4 X 3 | = | 12 | |
| | Line - | 3 X 3 | = | 9 | |
| | Color - | 2 X 3 | = | 6 | |
| | Texture - | 1 X 3 | = | 3 | |
| | | Subtotal | = | 30 | 30 |
| **Vegetation** | | | | | |
| Features | Form - | 4 X 3 | = | 12 | |
| | Line - | 3 X 3 | = | 9 | |
| | Color - | 2 X 2 | = | 4 | |
| | Texture - | 1 X 2 | = | 2 | |
| | | Subtotal | = | 27 | 30 |
| **Structures** | | | | | |
| Features | form - | 4 X 0 | = | 0 | |
| | Line - | 3 X 1 | = | 3 | |
| | Color - | 2 X 0 | = | 0 | |
| | Texture - | 1 X 0 | = | 0 | |
| | | | = | | |
| | | Subtotal | = | 3 | 30 |
| | | Total | = | 60 | 90 |

Degree of contrast:
Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score:
1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

Visual Resources
M. G. Hahn-O'Neill
Valentine Tract

CONTRAST RATING: 'Exploration' (proposed)

| Land Surface | Element | Contrast | Score | Maximum Score Possible |
|---|---|---|---|---|
| Features | Form - | 4 X 1 = | 4 | |
| | Line - | 3 X 1 = | 3 | |
| | Color - | 2 X 1 = | 2 | |
| | Texture - | 1 X 1 = | 1 | |
| | | Subtotal = | 10 | 30 |
| Vegetation | | | | |
| Features | Form - | 4 X 1 = | 4 | |
| | Line - | 3 X 1 = | 3 | |
| | Color - | 2 X 1 = | 2 | |
| | Texture - | 1 X 1 = | 1 | |
| | | Subtotal = | 10 | 30 |
| Structures | | | | |
| Features | | | | |
| | form - | 4 X 0 = | 0 | |
| | Line - | 3 X 0 = | 0 | |
| | Color - | 2 X 0 = | 0 | |
| | Texture - | 1 X 0 = | 0 | |
| | | = | | |
| | | Subtotal = | 0 | 30 |
| | | Total = | 20 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

Visual Resources
M. G. Hahn-O'Neill
Valentine Tract

CONTRAST RATING: Pilot (proposed)

| Land Surface | Element | Contrast | | Score | Maximum Score Possible |
|---|---|---|---|---|---|
| Features | Form - | 4 X 1 | = | 4 | |
| | Line - | 3 X 2 | = | 6 | |
| | Color - | 2 X 2 | = | 4 | |
| | Texture - | 1 X 1 | = | 1 | |
| | | Subtotal | = | 15 | 30 |
| **Vegetation** | | | | | |
| Features | Form - | 4 X 2 | = | 8 | |
| | Line - | 3 X 2 | = | 6 | |
| | Color - | 2 X 2 | = | 4 | |
| | Texture - | 1 X 2 | = | 2 | |
| | | Subtotal | = | 20 | 30 |
| **Structures** | | | | | |
| Features | | | | | |
| | form - | 4 X 0 | = | | |
| | Line - | 3 X 0 | = | | |
| | Color - | 2 X 0 | = | | |
| | Texture - | 1 X 0 | = | | |
| | | | = | | |
| | | Subtotal | = | 0 | 30 |
| | | Total | = | 35 | 90 |

Degree of contrast:
Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score:
1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

Visual Resources
M. G. Hahn-O'Neill
Valentine Tract

CONTRAST RATING: Production (proposed)

| Land Surface | Element | Contrast | Score | Maximum Score Possible |
|---|---|---|---|---|
| Features | Form - | 4 X 2 = | 8 | |
| | Line - | 3 X 2 = | 6 | |
| | Color - | 2 X 2 = | 4 | |
| | Texture - | 1 X 1 = | 1 | |
| | | Subtotal = | 19 | 30 |
| Vegetation | | | | |
| Features | Form - | 4 X 2 = | 8 | |
| | Line - | 3 X 2 = | 6 | |
| | Color - | 2 X 2 = | 4 | |
| | Texture - | 1 X 2 = | 2 | |
| | | Subtotal = | 20 | 30 |
| Structures | | | | |
| Features | form - | 4 X 0 = | 0 | |
| | Line - | 3 X 0 = | 0 | |
| | Color - | 2 X 0 = | 0 | |
| | Texture - | 1 X 0 = | 0 | |
| | | Subtotal = | 0 | 30 |
| | | Total = | 39 | 90 |

Degree of contrast: Strong = 3
Moderate = 2
Weak = 1
None = 0

Feature score: 1-10 - Contrast can be seen, but doesn't draw attention
11-20 - Attracts attention: contrast begins to dominate landscape
21-30 - Demands attention: will not be overlooked

APPENDIX VII

## CHECKLIST FOR ENVIRONMENTAL ASSESSMENT

EA No: UT-067-84-29 Project: Combined Hydrocarbon Lease Conversio

The following mandatory items have been considered in this Environmental Assessment. Items which may be impacted have been discussed within the Environmental Assessment; the remainder will not be affected and are not discussed.

Proposed Action: Convert Oil and Gas Leases U-37239 (Valentine), U-44399 and U-44400 (Kirkwood) to Combined Hydrocarbon Leases.

| | May Be Impacted | Will Not Be Affected | | Specialist Signature/ Date |
|---|---|---|---|---|
| 1. | a. [✓] Kirkwood | [✓] Valentine | Threatened or Endangered Species - Plants | D. Jeffrey Carroll 12-28-84 |
| | b. [ ] | [✓] | Threatened or Endangered Species - Animals | D. Jeffrey Carroll 12-28-84 |
| 2. | [✓] both | [ ] | Floodplains and Wetlands | Jesse 1/2/85 |
| 3. | [ ] | [ ] | Wilderness Values | |
| 4. | [ ] | [ ] | Areas of Critical Environmental Concern | |
| 5. | [ ] | [ ] | Visual Resource Management | |
| 6. | [ ] | [✓] both | Water Resources | Jesse 1/2/85 |
| 7. | [✓] Kirkwood | [✓] Valentine | Air Quality | Jesse 1/2/85 |
| 8. | [✓] Both. | [ ] | Cultural or Historic Resources | Blaine A. Miller 1/3/85 |
| 9. | [✓] Both | [ ] | Paleontological Resources | Neil A. Simmons 12-28-84 |
| 10. | [ ] | [✓] Both | Prime or Unique Farmlands | Jesse 1/2/85 |
| 11. | [ ] | [ ] | Wild and Scenic Rivers | |

The above project has been analyzed for conformance with BLM plans and consistency with local government plans. Significant discrepancies are discussed in the body of the Environmental Assessment.

BLM Plan and date: San Rafael Management Framework Plan was signed on October 16, 1979.

Local government plans and date: Emery County Comission passed a zoning resolution in January, 1984.

*UT-060-1790-4*
*September 1983*

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

## ENVIRONMENTAL ASSESSMENT WORKSHEET

1. Action Conversion of Oil and Gas Leases U-37239, U-4439 and U-44400 to Combined Hydrocarbon Leases

2. Stages of implementation

3. DISCRETE OPERATIONS

| 4. COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED | 5. ANTICIPATED IMPACTS: Exploration | Pilot Plant | Production | | | 6. REMARKS |
|---|---|---|---|---|---|---|
| **I. NONLIVING COMPONENTS** | | | | | | |
| A. AIR | | | | | | |
| Air Quality | -L | -M | -H | | | Little impact for Valentine Lease |
| Climate | 0 | 0 | 0 | | | |
| B. LAND | | | | | | |
| Topography | 0 | 0 | 0 | | | |
| Geology | 0 | 0 | 0 | | | |
| Soils | -L | -L | -L | | | |
| Paleontology | -X | -X | -Y | | | |
| C. WATER | | | | | | |
| Groundwater | 0 | 0 | 0 | | | |
| Surface water | 0 | 0 | -L | | | |
| **II. LIVING COMPONENTS** | | | | | | |
| A. PLANTS (*Aquatic*) | | | | | | |
| NA | | | | | | |

*(Continued on reverse)*

Form 1790-3 (June 1978)

DISCRETE OPERATIONS

| COMPONENTS, SUBCOMPONENTS, AND ELEMENTS IMPACTED | ANTICIPATED IMPACTS | | | | | REMARKS |
|---|---|---|---|---|---|---|
| | Exploration | Pilot Plant | Production | | | |
| **II. LIVING COMPONENTS (Con.)** | | | | | | |
| B. PLANTS (*Terrestrial*) | | | | | | |
| Grasses | -L | -L | -M | | | |
| Shrubs | -L | -L | -M | | | |
| Trees | -L | -L | -M | | | |
| Forbs | -L | -L | -M | | | |
| C. ANIMALS (*Aquatic*) | | | | | | |
| NA | | | | | | |
| D. ANIMALS (*Terrestrial*) | | | | | | |
| Mammals | -L | -L | -M | | | |
| Birds | -L | -L | -M | | | |
| Reptiles | -L | -L | -M | | | |
| **III. HUMAN VALUES** | | | | | | |
| A. LANDSCAPE CHARACTER | | | | | | |
| Wilderness | O | O | O | | | |
| Visual | -L | -M | -M | | | |
| B. SOCIOCULTURAL INTERESTS | | | | | | |
| Socioeconomics | +L | +M | +M | | | |
| Cultural | -X | -X | -Y | | | |
| Recreation | -L | -L | -M | | | |
| **IV. INTERRELATIONSHIPS** | | | | | | |
| A. ECOSYSTEM PROCESSES, STRUCTURES, AND FUNCTIONS | | | | | | |

## INSTRUCTIONS

1. *Action* – Enter action being taken, analytic step for which worksheet is being used, environmental viewpoint of impact, and any assumptions relating to impact.
   a. Worksheet is normally used to analyze "*Anticipated Impacts*" of action; *however*, it may be used to analyze "*Residual Impacts.*" Worksheets may also be used to compare impacts before and after mitigating measures are applied.
   b. State viewpoint that best describes environmental impact. For example, a fence viewed down the fence line has greater impact than the same fence viewed over an entire allotment. Generally, narrow viewpoints better illustrate specific impacts than will broad viewpoints.
   c. Assumptions may be made to establish a base for analysis (*e.g. estimated time periods, season of year, etc.*).

2. *Stages of Implementation* – Identify different phases of proposed project (*e.g. a road project consists of survey, construction, use, and maintenance stages*).

3. *Discrete Operations* – Identify separate actions comprising a particular stage of implementation (*e.g. the construction stage of the road project has the discrete operations of clearing, grading, and surfacing*).

4. *Elements Impacted* – Enter under appropriate heading all environmental elements susceptible to impact from action and alternatives. Relevant elements not contained in the digest should also be entered. See BLM Manual 1791, Appendix 2, Environmental Digest.

5. *Anticipated Impact* – Evaluate anticipated impact on each element and place an entry in the appropriate square indicating degree of impact as low (L), medium (M), high (H), no impact (O), or unknown or negligable (X). Preceed each entry by a plus (+) or minus (–) sign indicating a beneficial or adverse type of impact. If type of impact reflects a matter of opinion or is not known, *do not* preceed with a sign. For example, construction of a wind mill on open range has a definite visual impact; *however*, to some people the effect is detrimental while to others it is an improvement. By not entering a plus (+) or minus (–) sign the worksheet is kept factual and unbiased. If both degree and type of impact are unknown, place an (x) in the appropriate square.
   a. The measures of impact (*e.g. low, medium, and high*) are relative and their meaning may vary slightly from action to action. The term "*low*" should not be applied to impacts of a negligible nature. For example, we know that a pickup truck driving down a proposed fence line laying wire has some impact on air quality. However, the significance of this impact is not normally great enough to warrant even a "*low*" rating. In cases like this, the impact will usually be marked "*O*" or the element left off the worksheet.
   b. It is recognized that some environmental elements may defy accurate measurement or in-depth analysis within current Bureau capabilities or expertise. The nature of the action as well as type and degree of impact should guide in the decision to seek outside expertise or assistance.

6. *Remarks* – Enter clarifying information.

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Moab District
San Rafael Resource Area
P. O. Drawer AB
Price, Utah 84501

1791
(U-067)

Dear Reader:

Enclosed for your review and comment is the Draft Environmental Assessment (EA) for the San Rafael Swell Combined Hydrocarbon Lease Conversion proposal. This document was prepared pursuant to Section 102(2)(c) of the National Environmental Policy Act of 1969 and is in accordance with the Council of Environmental Quality Regulations (40 CFR 1501.3, 1508.9).

This Draft EA was prepared to analyze the environmental consequences that could result from implementing the combined hydrocarbon lease conversion applications of Kirkwood Oil and Gas and Richard J. Valentine. Their current oil and gas leases are in the San Rafael Swell Special Tar Sands Area (STSA) in central Emery County, Utah.

The San Rafael Management Framework Plan has been amended to allow combined hydrocarbon lease conversions in the San Rafael Swell STSA. The alternatives to amending the plan and their possible impacts were analyzed in the Utah Combined Hydrocarbon Leasing Regional Final EIS completed in June 1984. This Final EIS is incorporated by reference into this Draft EA.

Readers are invited to comment on this Draft EA. Comments should be sent to:

Sam Rowley, Area Manager
Bureau of Land Management
P.O. Drawer AB
Price, Utah 84501

Comments must be received by May 15, 1985, to receive consideration in the preparation of the Final EA.

Sincerely yours,

Samuel R. Rowley

Samuel R. Rowley
Area Manager

Enclosure:
Draft EA

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